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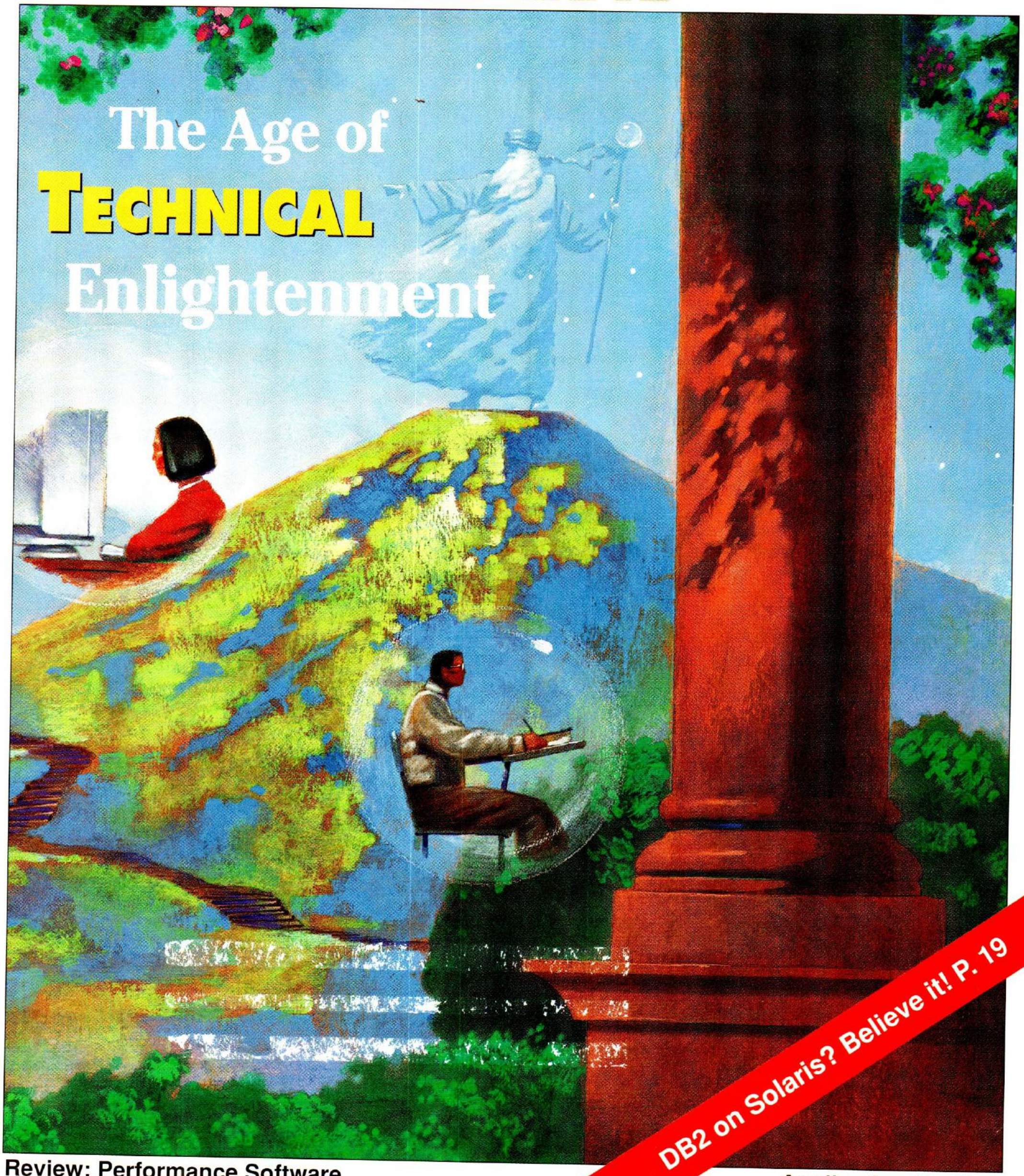


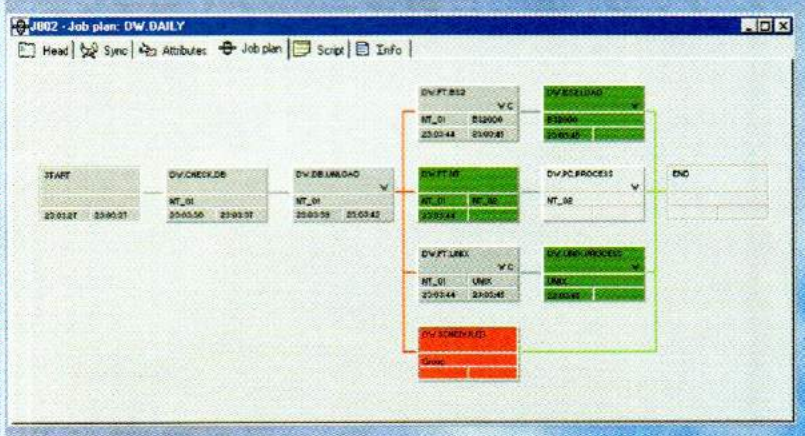
Review: Performance Software

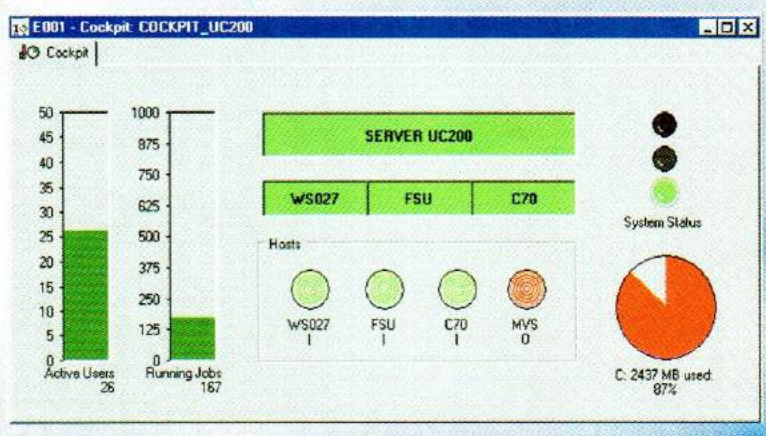
DB2 on Solaris? Believe it! P. 19

Application Hosting

"Enterprise Wide Job Scheduling"

UC4





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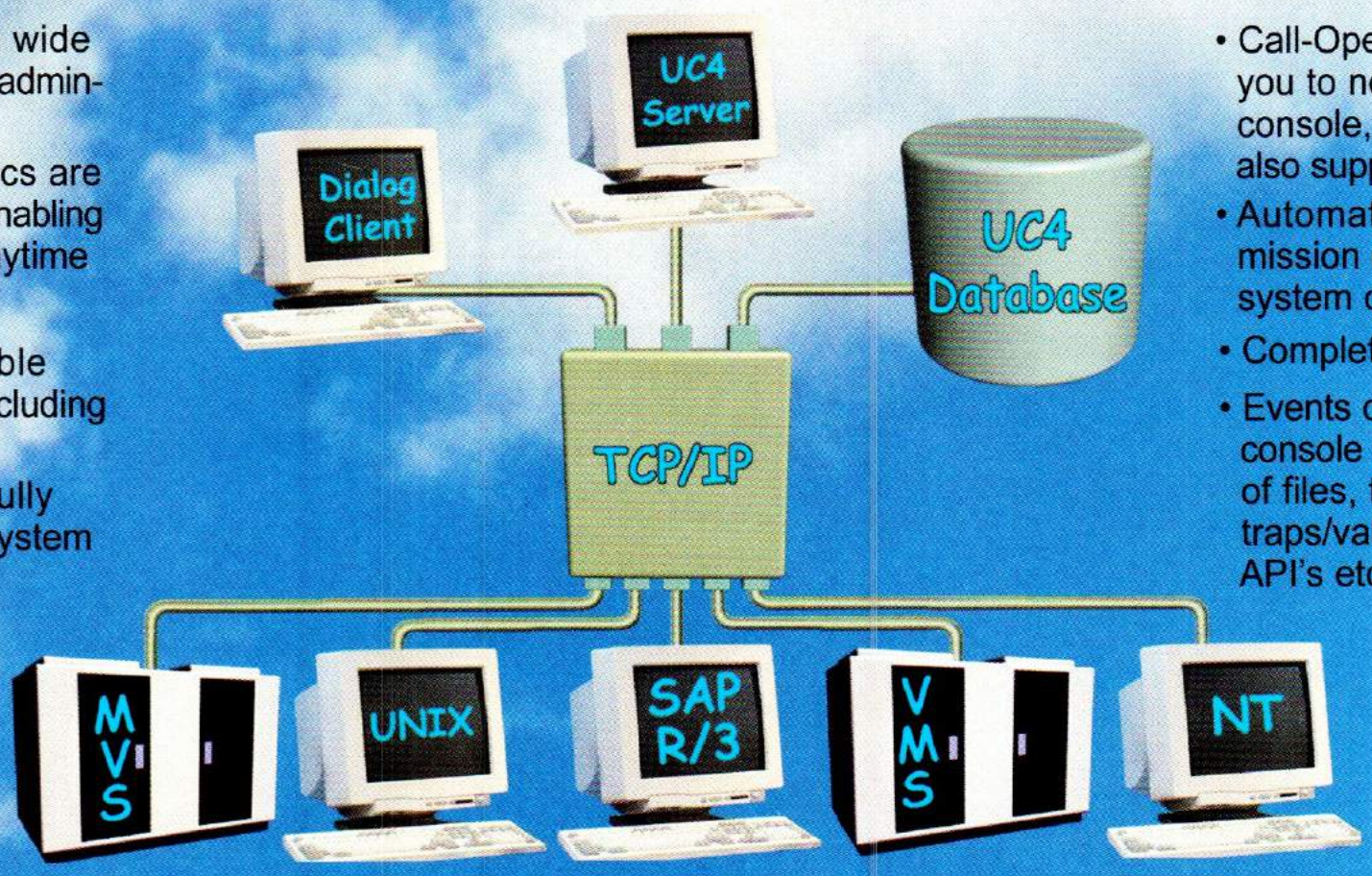

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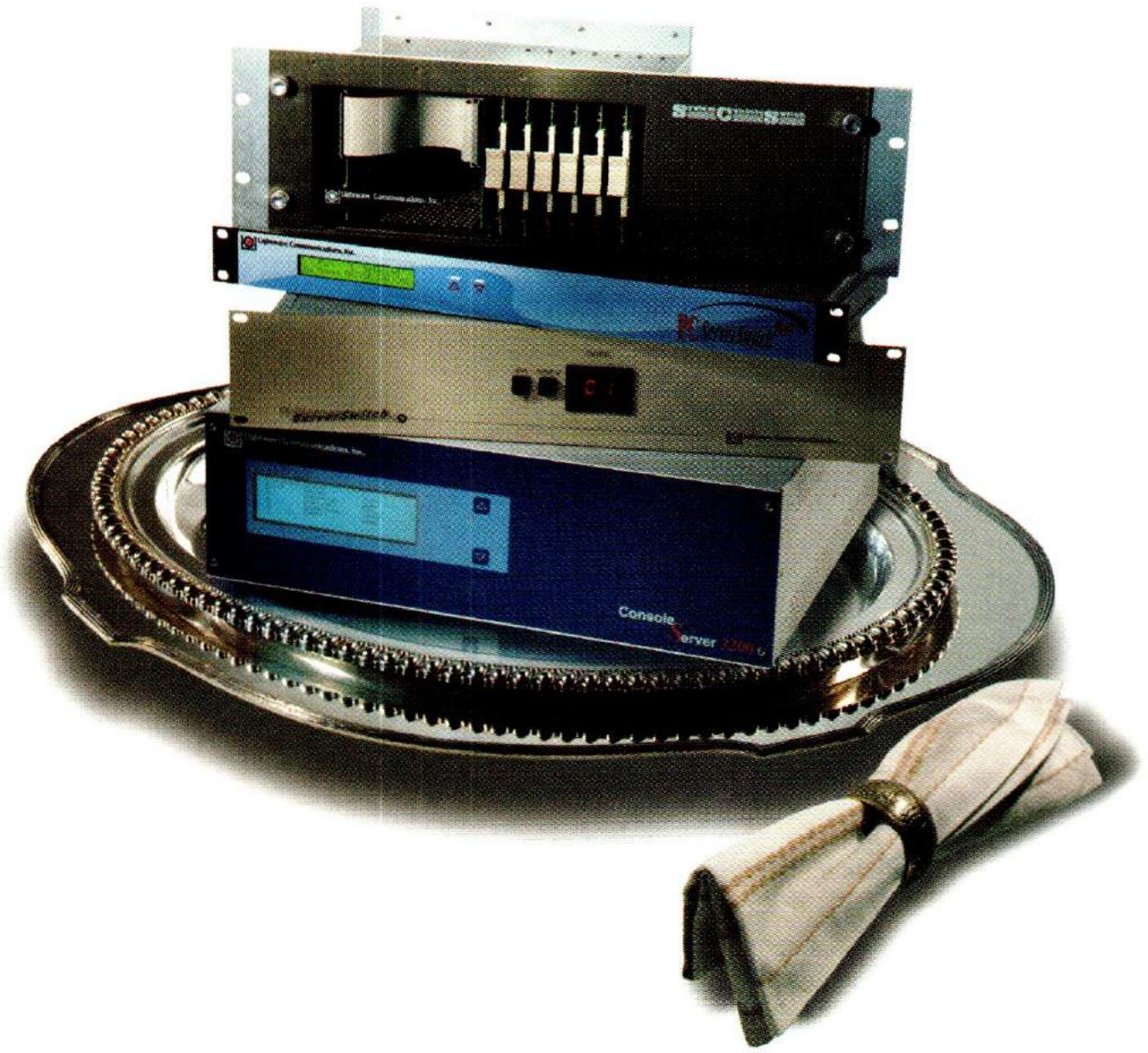

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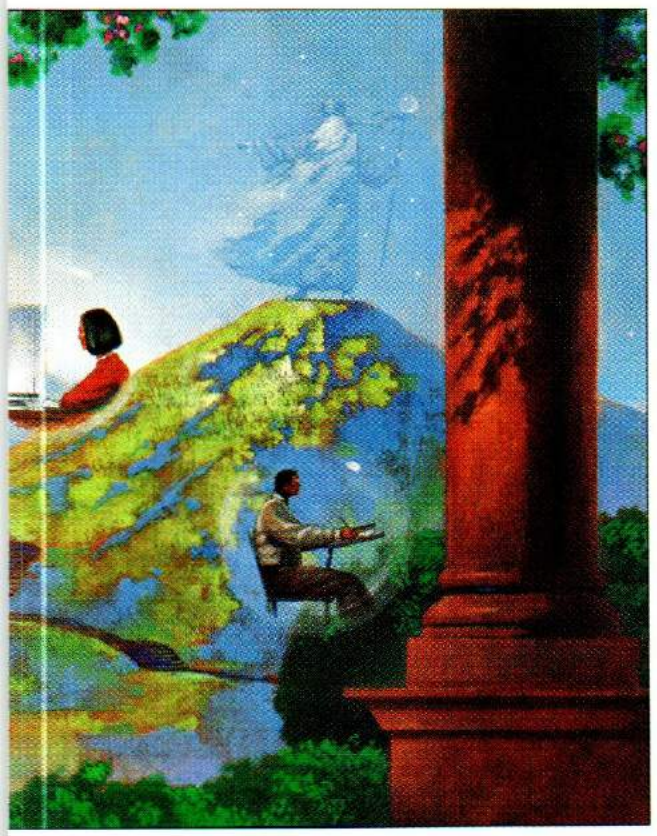
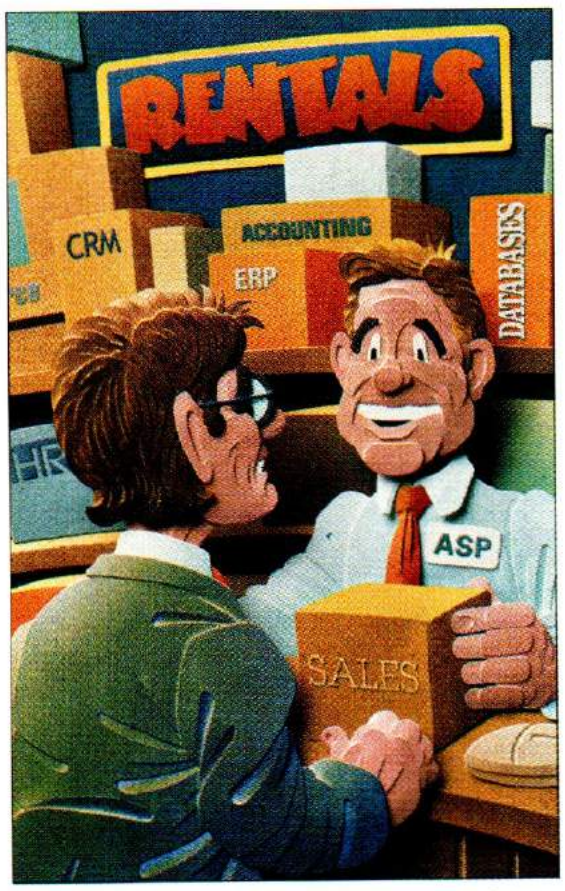
Contents



PAGE 44



PAGE 52

8 News

Includes: Sun Brews Micro Java; Back on Track?; Sun Expands Solaris Certification; Sequent Turns to Big Blue.

44 Cover Story

by Patrick T. Coleman, Staff Editor

The Age of Technical Enlightenment

From the classroom to the chat room, the search for IT know-how can take many forms.

52 Feature

by Suzanne Hildreth, Staff Editor

Build, Buy or Borrow?

With everyone from telecommunications companies to software vendors leaping into the application hosting market, it behooves potential customers to watch their step in making the buy versus rent decision.

58 Product Review

by Ian Westmacott, Technical Editor

Peformance Management for the Enterprise

If performance is crucial–especially with regard to problem determination and capacity planning–and you're serious about analysis, then TeamQuest Performance Software is well worth a look.

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Columns

18 Ask Mr. Protocol

by Michael O'Brien

Mr. P. and the Failure of the Net

Mr. P. laments over the failure of something at which the Internet ought to shine. It seems most people would rather fly 3 million miles per year than use the Internet to hold meetings.

PAGE 18

24 UNIX Basics

by Peter Collinson

Small Text Databases

A step-by-step guide to creating a searchable text database from scratch using the standard set of UNIX tools.

32 Work

by Jeffreys Copeland and Haemer

A Pipe Ptool

The Jeffs make another donation to Tom Christiansen's growing pile of free UNIX utilities written in Perl. This time, they provide their own implementation of the POSIX *mkfifo* interface, which lets you create a fifo from the command line.

PAGE 32

38 Java Class

by Jim Frost

Going Native

One of the problems with so-called system independent programming languages is they limit their functionality to a subset available across all of the supported systems. Luckily, Java provides an escape hatch, the Java Native Interface, which can be used to call back and forth between C/C++ code and Java.

COMING NEXT ISSUE
Java Development

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Departments

6 Editorial
62 New Products
68 Server/Workstation Marketplace
80 Advertisers' Index

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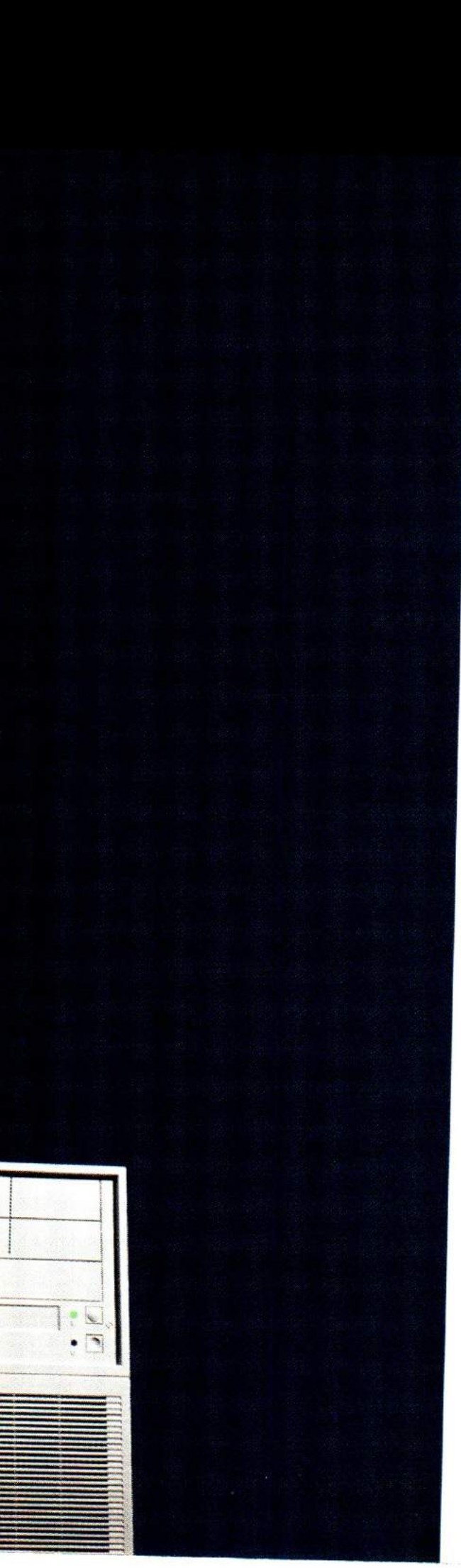

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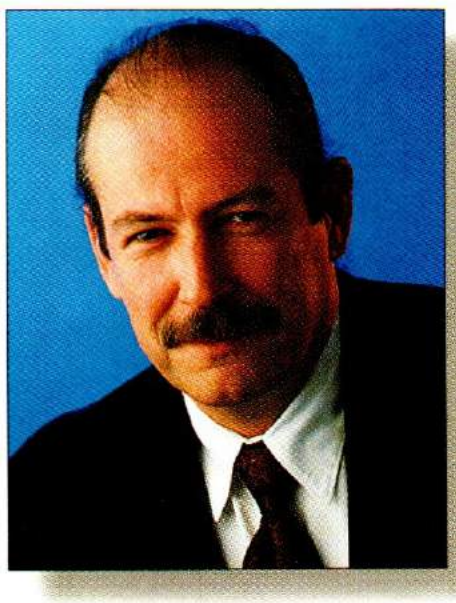

Learn or Rent

The search for digirati has certainly intensified as the economy's dependency on technology has grown. Unfortunately, at many companies, either through the failing of our educational system or the fact that a computer career is no more glamorous than pursuing a life in hip-hop on MTV, IT managers are looking for ways of training new recruits or retraining experienced hands for new skills. It all amounts to a search for technical enlightenment as Pat Coleman puts it in this month's cover story on UNIX training–"The Age of Technical Enlightenment," Page 44.

Pat finds that IT professionals today can choose from a wide array of approaches to learning new skills. "They range from sitting in a classroom for an instructor-led session to technology-based training (TBT), which includes computer-based training (CBT) methods such as CD-ROM," he says. He also notes that to the surprise of many of us crusty skeptics, "even in this the digital age" some hearty souls are still turning to books. If my mailbox is any indication, there are billions and billions of these to resort to; however, the classroom setting is still the dominant delivery method for IT training, according to Pat. In fact, more than 72% of all IT courses are in a classroom setting. So says a 1998 survey conducted by the American Society of Training and Development, Alexandria, VA, an association of professionals in the field of workplace learning.

If you're looking for a way to enhance your own skill set or to find out about the strengths and weaknesses of each training method from people with firsthand experience, be sure to check out Pat's findings.

If you don't have the trained IT staff or other resources to manage your technology infrastructure, you'll want to take a look at "Build, Buy or Borrow?" Page 52. It's the story of application hosting–you farm out major portions of your information systems to an application service provider (ASP). Suzanne Hildreth takes you through the current thinking on this new approach. Just in case you think it's not real, International Data Corp. (IDC), a Framingham, MA-based research firm, estimates the demand for application rental and hosting services will reach $2 billion by 2003. IDC says this market will be driven by increased acceptance of outsourcing, better networking technologies and the increasing ubiquity of electronic commerce, which forces businesses of all sizes to implement and maintain sophisticated Web sites.

If you can't learn it , you can always rent it.

Doug Pryor

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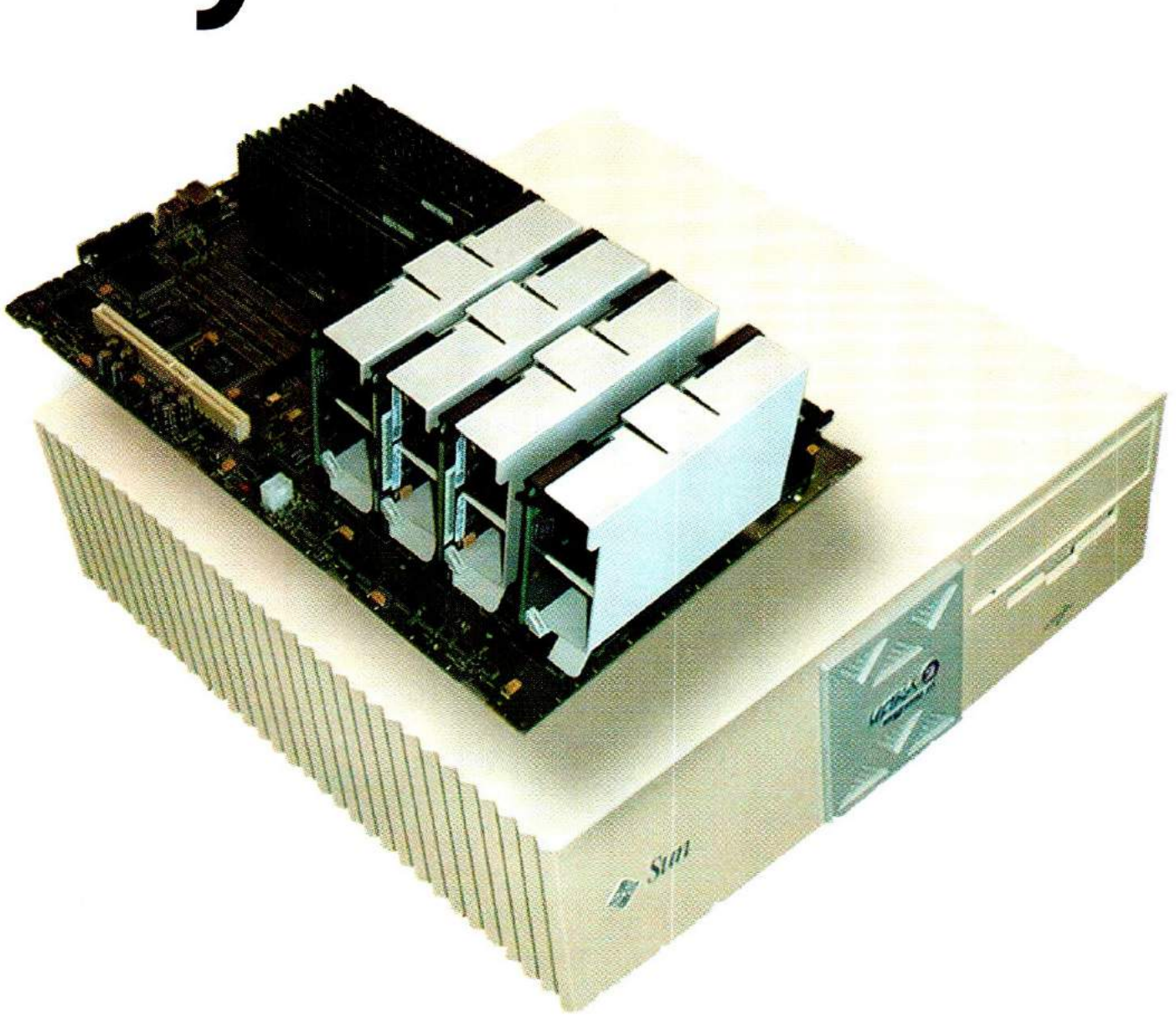

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Sun Brews Micro Java

Java is moving into the micro arena of pagers, phones and personal digital assistants (PDAs). In June, Sun Microsystems Inc., Palo Alto, CA, released its Java 2 Platform, Micro Edition for handhelds and other computer devices. Micro Edition is the third release in Sun's line of Java 2 Platform "editions," after the Standard Edition and Enterprise Edition.

This new version of the Java platform builds on Sun's EmbeddedJava and PersonalJava specifications by adding device "profiles," or collections of Java APIs and class libraries specific to certain device types. The profiles are designed to enable independent software vendors (ISVs) to develop applications that can run on a number of products from different manufacturers, as long as the products support that device profile.

Curtis Sasaki, director of product marketing for consumer and embedded products at Sun, says ISVs who want to develop software for a specific category of device products can use the profile as their guide. "We've learned over the last couple of years in the embedded space that one size does not fit all, and we wanted to make sure we provide the appropriate set of APIs for particular industry segments," Sasaki says.

An adjunct component of the Micro Edition is the K Virtual Machine (KVM), a new JVM aimed specifically at embedded devices. The KVM, which takes up just 40 KB of disk space, can run on devices with as little as 128 KB of RAM, Sun says.

However, not all device makers will be rushing to support Micro Edition, says Ron Workman, senior vice president of marketing for Insignia Solutions Inc., Fremont, CA, a Sun licensee that makes an embedded VM called Jeode EVM. That's because many industry groups have already developed specifications for their niche markets based on Sun's existing EmbeddedJava and PersonalJava specifications. "A lot of work has already been going on, and folks I've talked to view this as something that will probably be interesting at some point, but they've already got their specifications drafted."

Workman points to industry consortiums such as the Automotive Multimedia Interface – Collaboration (http://www.ami-c.com) and the DTV Application Software Environment (DASE), a special group of the Advanced Television Systems Committee (http://www.atsc.org), as examples of groups that are already developing their own specifications.

In addition, says Sun's Sasaki, makers of deeply embedded products, such as network routers and other devices with dedicated functionality, may be less interested in Micro Edition because they'll have less need to encourage third-party software support for their products.

Sun also faces competition from other vendors in the embedded VM space. Hewlett-Packard Co., Palo Alto, CA, for one, is nipping at Sun's heels. In June, HP released a new version of its embedded VM, ChaiVM 3.0. So far, HP and the J Consortium (http://www.jconsortium.org)–a not-for-profit consortium that includes HP and Microsoft Corp., Redmond, WA, but not Sun–have a reasonably long list of supporters that includes smart card producer Schlumberger Ltd., New York, NY, electronics giant Mitsubishi Electronics Corp., Tokyo, and Wind River Systems Inc., an Alameda, CA-based software developer for the embedded market.

ADAM DARBY

But Sun also boasts strong support, most notably from 3Com Corp., Santa Clara, CA, Motorola Inc., Schaumburg, IL, and NTT Mobile Communications Network Inc., a large Japanese mobile communications operator with nearly 26 million mobile phone subscribers. NTT has added KVM support to its cell phone products using its i-mode Internet access service. Motorola demonstrated a version of its PageWriter pager product running the KVM at the JavaOne conference in San Francisco in June. Also at JavaOne, 3Com, which has ported the KVM to its Palm VII handheld computer, did a joint promotion with Sun, which involved selling

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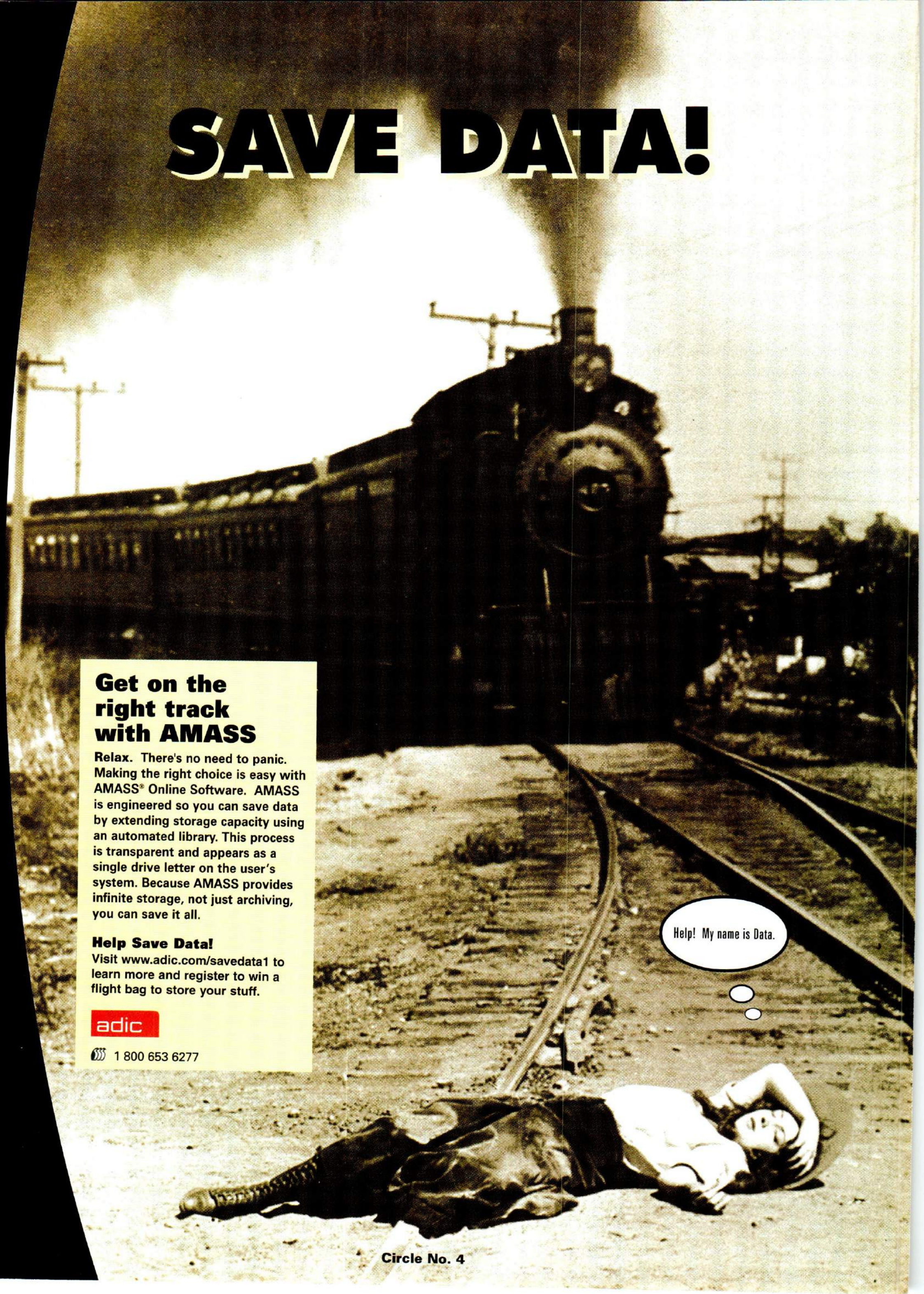

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discounted Palm devices preloaded with a KVM and Java-based games to conference attendees.

Craig Roth, senior research analyst for the Meta Group Inc., Stamford, CT, says both the Sun and HP embedded VMs will probably find niches in the market, although Sun is likely to dominate. "Right now, there's practically no difference between the two," says Roth. "Until they start to diverge technically, it's an issue of who can best control the market. And I think Sun will win out most of the time, especially in the area of customized corporate devices, although [HP's] Chai might be the winner in consumer devices. But I see Sun getting a majority of the market," Roth says.–*sjh*

Back on Track?

The process has been slow but there are signs that Compaq Computer Corp., Houston, TX, and Digital Equipment Corp., Maynard, MA, have finally reached a level of manageable integration. In what has been an arduous merger, Compaq now seems poised to deliver a consolidated product line. "[The merger] has been very difficult," says Lindy Lesperance, analyst with Technology Business Research Inc., a market research firm based in Hampton, NH. "It has been more difficult than Compaq initially thought it would be."

Since it was announced in June 1998, several factors have developed that have prevented the merger from running smoothly. One was increased competitive pressures in the PC marketplace, Compaq's bread and butter. There was also turmoil within the company's upper management structure, and a general difference in working environments between DEC and the Texas PC manufacturer. All of this made combining the two companies' operations more difficult.

Since it was announced in June 1998, several factors have developed that have prevented the merger from running smoothly.

One of the more troublesome tasks has been laying off more than 15,000 employees since the merger, with Compaq announcing in July that it will have to cut another 6,000 to 8,000 jobs.

"You have two very different corporate cultures. Compaq was essentially a box vendor taking on Digital's tremendous breadth of products and services," Lesperance says. "It has been even more difficult for Compaq to swallow Digital overseas, especially in Europe where each geography has its own structure and its own culture."

One bright spot is the company's upper management issues seem to have been resolved. On July 22, Compaq named chief operating officer, Michael Capellas, the new chief executive officer (CEO). His selection ended a three month search that began when former CEO Eckhard Pfeiffer and chief financial officer Earl Mason were forced to resign. That was quickly followed by the resignations of John Rando, head of services, and John Rose, head of enterprise computing. With the upper management exodus seemingly over, Compaq is hoping to finish assimilating DEC by streamlining the two companies' operations.

Amid all the management turnover, the direction the company intends to go with enterprise computers and how it will use the DEC product line–partic-

Sun Expands Solaris Certification

Sun Microsystems Inc., Palo Alto, CA, is extending its Solaris-Ready certification program for hardware products to software applications. Now, Solaris software developers can pay a onetime fee ($800 per product) to testing company KeyLabs Inc., Lindon, UT, to have their products tested on the Solaris operating system.

According to Lisa Davies, manager of branding and certification programs for Sun, software will be tested in four key areas: ease of installation, ability to function well with the Sun Common Desktop Environment (CDE), compliance with Sun's Y2K standards and binary compatibility with Solaris.

"It gives customers the knowledge that the product has passed baseline testing," Davies says.

According to Sun, approximately 20 software vendors have signed up for the Solaris-Ready program so far, joining 25 existing hardware vendors. All of the products that pass the KeyLabs test will be eligible to be listed on Sun's new SunStore site (`http://sunstore.sun.com`), which was launched in July. "Developers are always asking us, 'How do we get access to your channels?' Well, this is automatic when you become Solaris-Ready," Davies says.

Neither Hewlett-Packard Co., Palo Alto, CA, nor Compaq Computer Corp., Houston TX, currently offer certification programs for independent software vendors (ISVs). However, IBM Corp., Armonk, NY, does offer a certification program for its AIX operating system. Casey Cannon, marketing programs manager for IBM, says approximately 15% to 20% of AIX software vendors put their products through IBM's free AIX-Ready certification program, which is conducted by the ISV with the results submitted to IBM. "Most ISVs are going to test their application one way or another, either by going through the AIX-Ready test suite or by getting [an RS/6000] box from us," Cannon says.

AvantGo Inc., San Mateo, CA, is putting the new version of its AvantGo Server through the certification process, partly to take advantage of SunStore. "We're in the process of releasing our first server on Solaris, so the impetus to join the program was to have Sun's help in penetrating that market," says Diana Ungersma, product manager for enterprise products at AvantGo.

Ungersma adds that Microsoft Corp., Redmond, WA, already requires testing of third-party products that want to bear the Windows logo, which customers come to expect on their products. "It's been a huge bonus to have that logo," she says.–*sjh*

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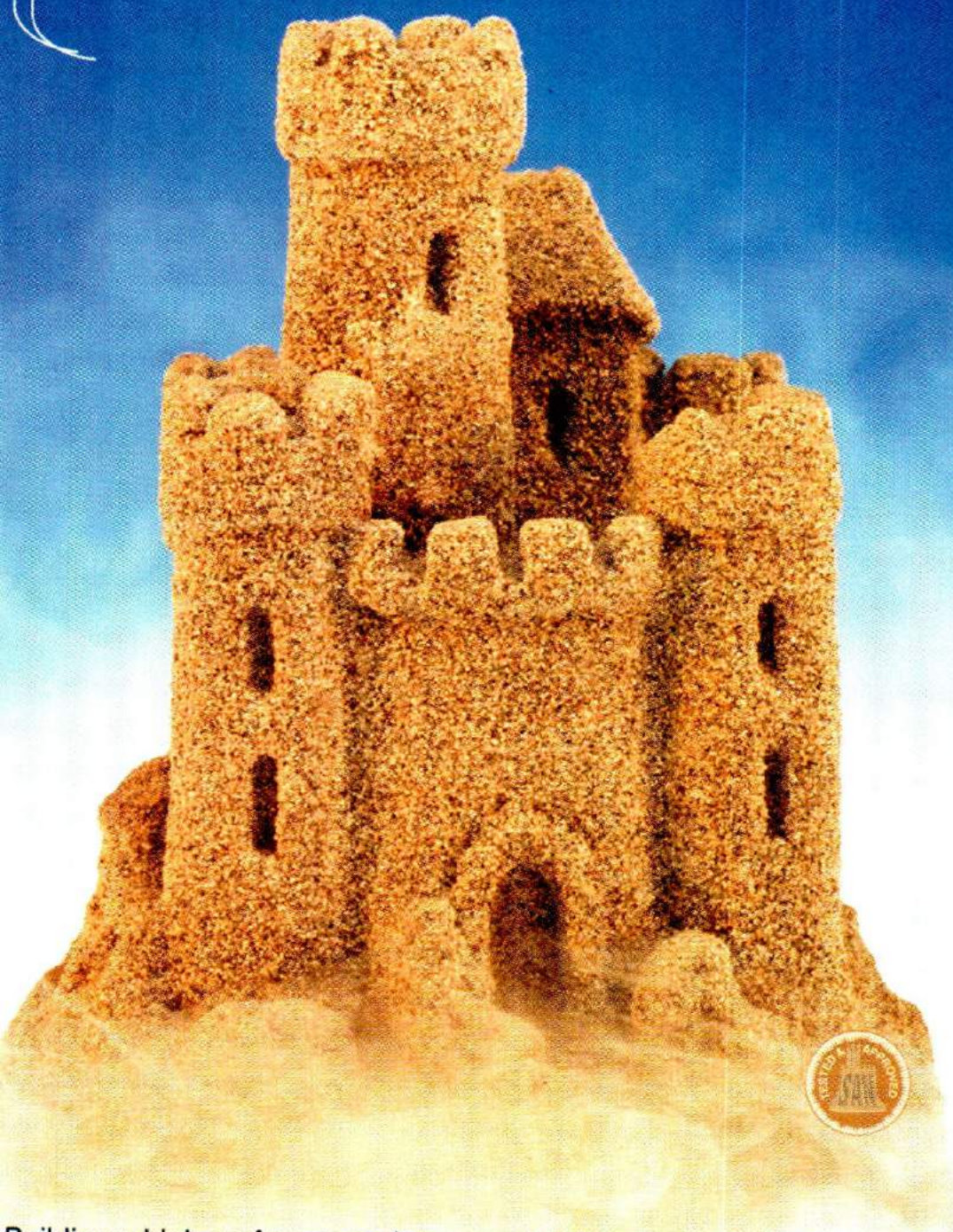

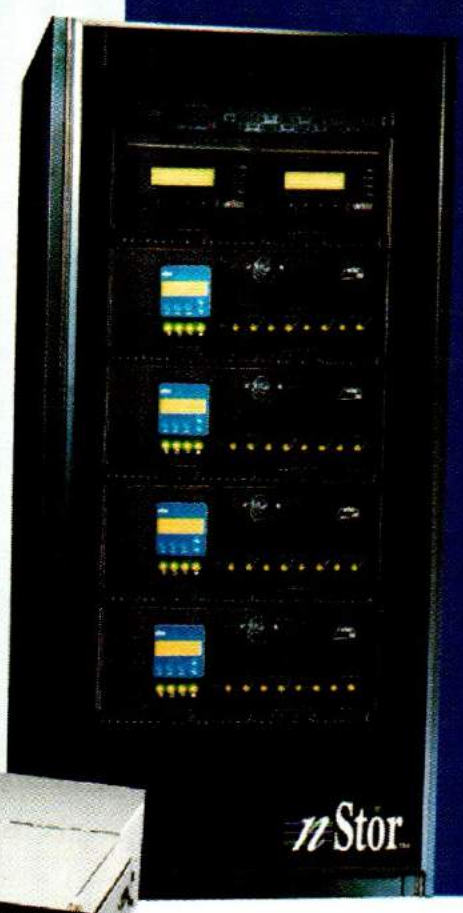

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Worldwide UNIX Server Shipments

	1997 Shipments (units)	1997 * Market Share (%)	1998 Shipments (units)	1998 * Market Share (%)
Sun	83,909	19.7	127,822	30.0
HP	72,963	17.2	74,657	17.5
IBM	62,956	14.8	54,387	12.8
Compaq	41,937	9.9	47,455	11.1
NCR	23,241	5.5	15,494	3.6
DEC	23,306	5.5	11,953	2.8

Worldwide UNIX Server Revenue
(in millions of U.S. dollars)

	1997 Revenue	1997 * Market Share (%)	1998 Revenue	1998 * Market Share (%)
HP	3,907	23.0	4,933	27.4
Sun	3,216	19.0	4,431	24.6
IBM	2,709	16.0	2,632	14.6
Siemens	900	5.3	1,033	5.7
SGI	1,115	6.6	888	4.9
NCR	1,204	7.1	751	4.2
Compaq	227	1.3	695	3.9
DEC	707	4.2	496	2.8

* Total market breakdown not shown.

Source: Dataquest Inc., San Jose, CA

ularly the AlphaServer line, which it inherited following the merger–has been difficult to gauge.

"I'm still trying to figure out what Compaq's UNIX strategy is," says Kimbal Brown, vice president and chief analyst at San Jose, CA-based research firm Dataquest Inc. "They support somewhere in the neighborhood of eight or nine UNIXes, and they say True64 and Linux are the future. That is what they say and maybe that's what they mean. I don't know."

Since the merger, Compaq has made several Alpha workstation and server announcements. Most notably, in July, the company introduced the AlphaServer GS60E, an Alpha 21264-based, Tru64 UNIX server. The GS60E has received rave reviews from analysts. Industry market research company D.H. Brown & Associates Inc., Port Chester, NY, praised the new server in its July newsletter, saying: "This [AlphaServer] breaks from the architectural limitations of previous-generation Compaq/Digital servers to deliver uncompromised expandability without resorting to a cluster solution."

An entry-level GS60E costs $85,000 and comes with two 525-MHz Alpha 21264 processors, 1 GB of memory, 9-GB disk and Tru64 UNIX license. Compaq has also promised to deliver the next-generation Alpha processor, the EV67, by the end of the year. The entire GS server line was designed so it could upgrade to the EV67, which will reportedly be a 700-MHz chip with 8 MB of cache memory.

Dataquest's Brown sees Compaq's commitment to Alpha as a way of maintaining its current business while the company awaits the release of Intel Corp.'s IA-64. "Compaq wants to keep the Alpha users intact as much as possible," he says. "There is revenue there, why take it away?"

Brown says Compaq will focus its efforts on the IA-64 processor, and will likely jump on the Linux bandwagon. "In 2001, it is going to be a very different story. It will be very clear that Tru64 on IA-64 is their direction, and Linux is the direction on the lower end. This is what they are going to push," Brown says.

Over the next few months, Compaq's plans for UNIX should become clearer. When Capellas was formally introduced as CEO, he promised to announce product "rationalization" by the end of the year. But for the moment, with the release of products like the GS60E, Compaq is committed to Alpha and continues to improve the product line.

Jeffrey Goldenbaum, product manager for Dataram Corp., a Princeton, NJ-based memory manufacturer that sells SDRAM memory for the AlphaServer line, says Compaq is committed to the DEC platform.

"They are still developing the Alpha processor. They are working on a faster and newer processor," he says. "I'm pretty sure they are dedicated to the Alpha processor and they have been able to use Compaq's strengths as the biggest computer company in the world to market and sell it," Goldenbaum says.

The key to the company's direction is now in the hands of the new CEO. "Capellas is a good choice," says Technology Business Research's Lesperance. "He is an IT person. He understands customers. He will be able to talk with them easily. He is already perceived as more reachable than Eckhard Pfieffer," Lesperance says.–*ptc*

Sequent Turns to Big Blue

It was an offer it couldn't refuse. Thanks to the deep pockets of IBM Corp., Armonk, NY, Sequent Computer Systems Inc., Beaverton, OR, will now have access to Big Blue's resources to help it compete. On July 12, IBM agreed to pay $810 million to make Sequent one of its subsidiaries.

"This [aquisition] addresses the major issues we faced: size, reach and software availability," says Casey Powell, chief executive officer of Sequent. "These are issues that continually undermine our sales."

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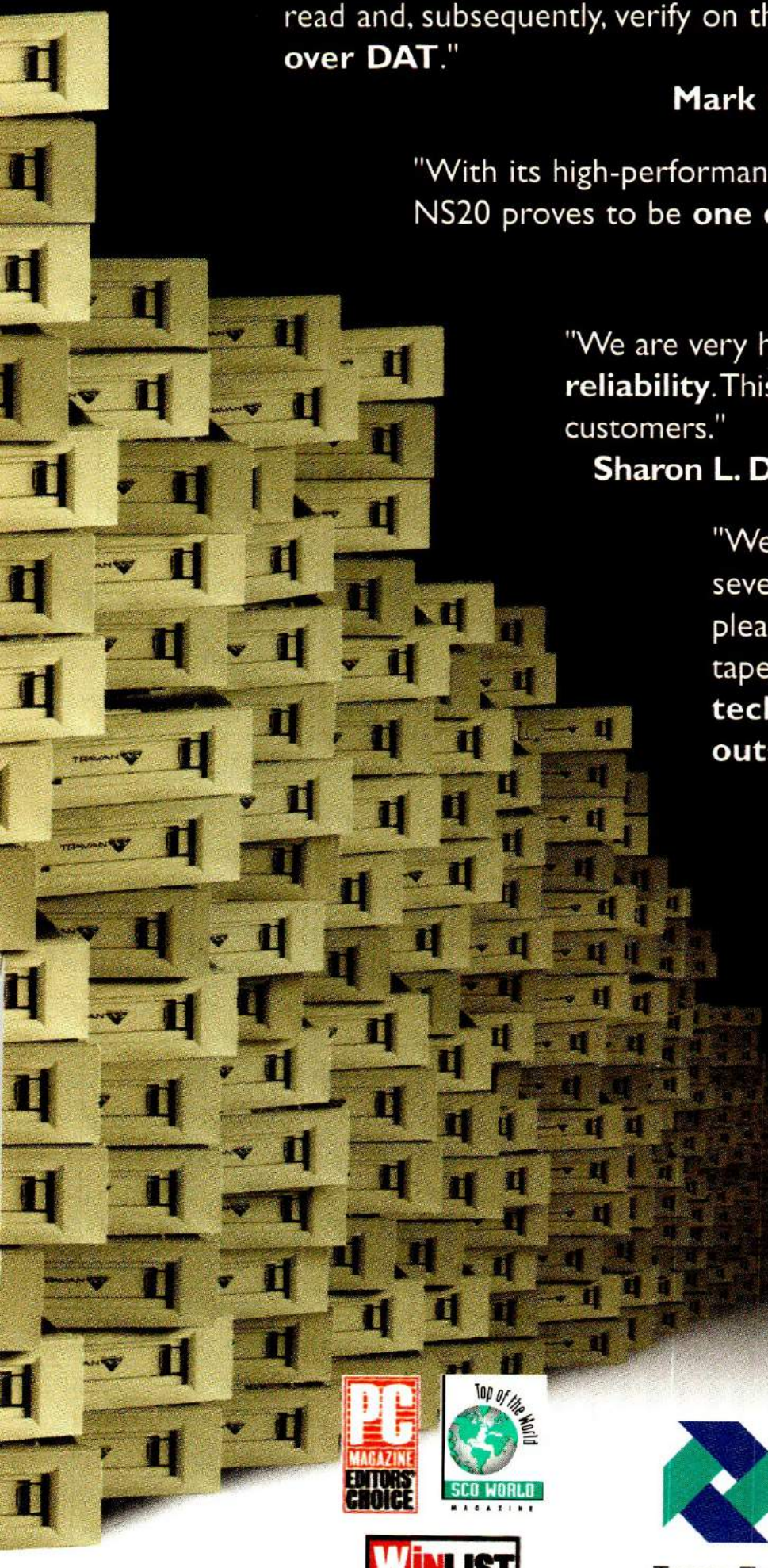

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Circle No. 6

computer hardware and software for Intel-based systems, but has never been able to establish itself as a major player in the marketplace. The company lost $52.5 million in 1998. "It is a disadvantage to us being a company that has yet to reach a billion dollars [in revenue], competing on a daily basis with 20, 40 and 50 billion-dollar giants," he says. "We will now be a part of the largest computer company in the world, and we intend to flex their muscle."

ADAM DARBY

One factor that particularly attracted IBM to Sequent, analysts say, was the company's NUMA (nonuniform memory access) technology. NUMA is a hardware and software system that allows up to 64 Intel processors to operate as a single system. "That's the whole reason they bought Sequent–because of the NUMA architecture," says Joyce Bicknell, director of UNIX and enterprise systems for The Aberdeen Group, a Boston, MA-based research firm. "NUMA allows you to scale beyond the limitations of symmetrical multiprocessing."

Robert Stephenson, senior vice president of IBM and group executive of IBM's server group, gives high praise to the Sequent technology. "NUMA will be the defining technology for the early 21st century UNIX and NT servers," he says.

Talk of a possible union between the two companies began when IBM and Sequent, along with The Santa Cruz Operation (SCO) Inc., Santa Cruz, CA, Compaq Computer Corp., Houston, TX, Intel Corp., Santa Clara, CA, and Unisys Corp., Blue Bell, PA, started working together on Project Monterey. The project is an attempt to create a high-volume enterprise-ready commercial UNIX software system to run on Intel's forthcoming IA-64 chip, known as Merced. This new operating system will be an amalgamation of IBM AIX, SCO UnixWare and NUMA technology. "This investment speaks louder than any words about our commitment to the success of Project Monterey," Stephenson says. "Sequent brings unique skills and competencies in developing enterprise-class UNIX servers."

IBM also intends to integrate the Sequent technology into its existing product lines. Industry watchers believe NUMA will eventually be available in IBM's Netfinity NT servers, to provide additional scaling capabilities. However, IBM says that despite the scaling benefits NUMA brings to Intel servers at the high-end, the company has no intention of positioning it against the RS/6000 UNIX family. "We are totally committed to our RS/6000 UNIX server line and our Netfinity NT business," says Stephenson. "This merger will be complementary to both these businesses."

Sequent will continue to operate out of its Beaverton headquarters, and there are no job cuts currently planned.–*ptc*

Compaq, CA Beef Up Storage

In June and July, Houston, TX-based Compaq Computer Corp. rolled out a collection of storage management software and hardware products. This latest round of announcements–part of the company's Enterprise Network Storage Architecture road map unveiled in December–includes hardware products such as a new RAID array, as well as software solutions for data management.

The products represent incremental, rather than dramatic increases in Compaq's storage offerings, says David Hill analyst with The Aberdeen Group, Boston, MA, but they nonetheless reflect positively on Compaq's steady and consistent dedication to the storage market.

"Compaq is very good about executing against their plan and delivering products on a regular timetable, adding more capabilities as time goes on," says Hill. "They're fitting in the pieces in a logical progression to fill any gaps."

Compaq's hardware announcements include the new StorageWorks RAID Array 4000, a revamp of Compaq's Fibre Channel Storage System, with dual controllers for high availability and up to 3.2 TB of storage per server for $17,000; a new workgroup version of the company's storage area network (SAN) backup solution, the StorageWorks Enterprise Backup Solution, which connects via Fibre Channel directly to servers running on Windows NT or NetWare LANs (price varies depending on configuration); new Server Console Switches, which allow IS managers to manage several servers from one terminal ($965 each); and new Ultra2 Universal hard disk drives for Compaq's AlphaServer or ProLiant servers (starting at $590 each).

Compaq also announced new storage management software. In June, the Compaq StorageWorks Virtual Replicator software made its debut. The Virtual Replicator enables administrators to pool RAID and Just a Bunch Of Disks (JBOD) arrays into wholesale disk blocks and then repartition them into "virtual" disks. Users see only the virtual disks, not the physical storage locations. This is useful for managing large databases or other applications that normally require more than one physical disk drive for storage, Hill says. It also enables administrators to assign users individual disks tailored to their specific storage needs.

A second feature of the Replicator software is the ability to take "snapshots" of data. The snapshots aren't actual backups of the data, Hill says,

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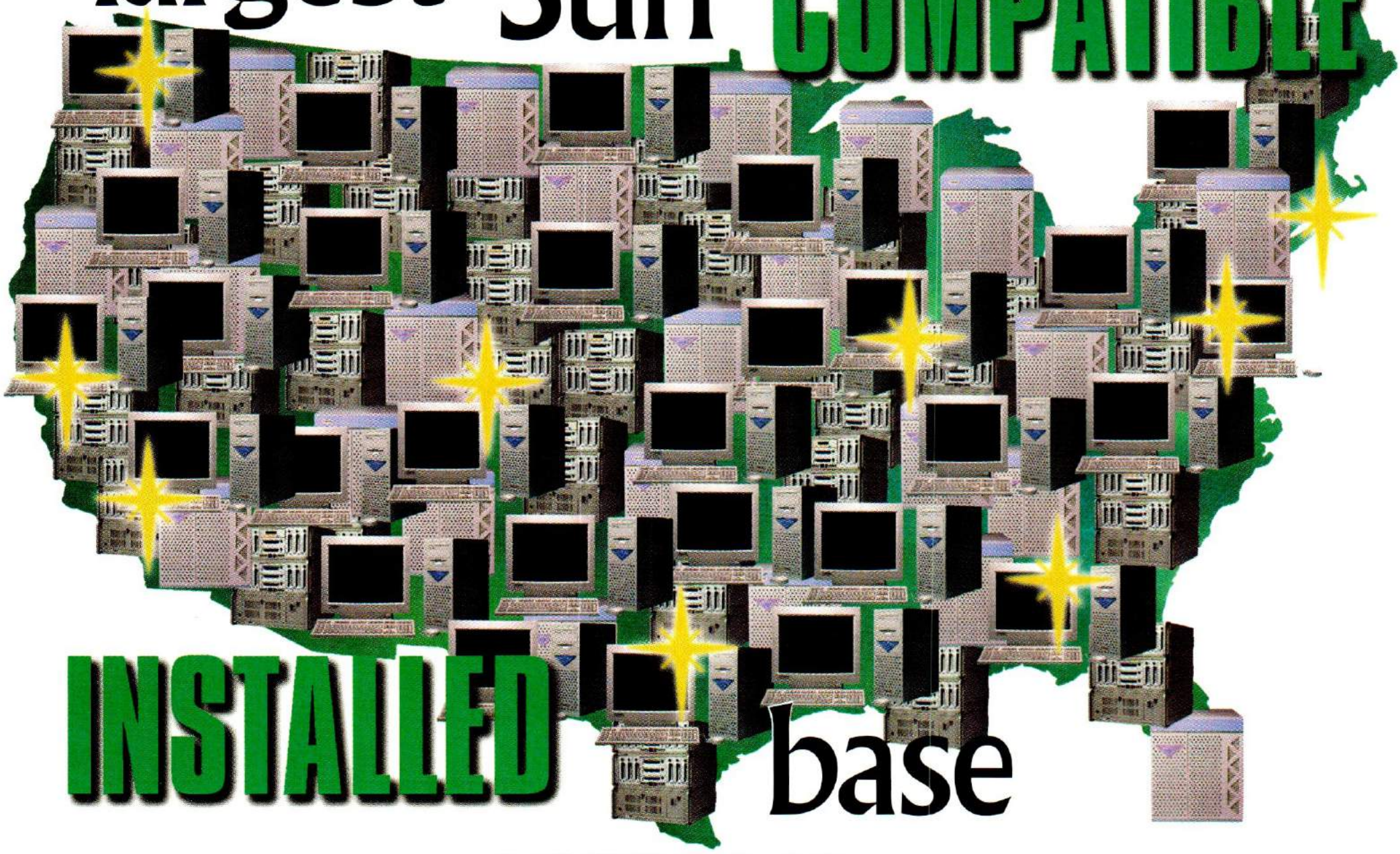

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18GDA

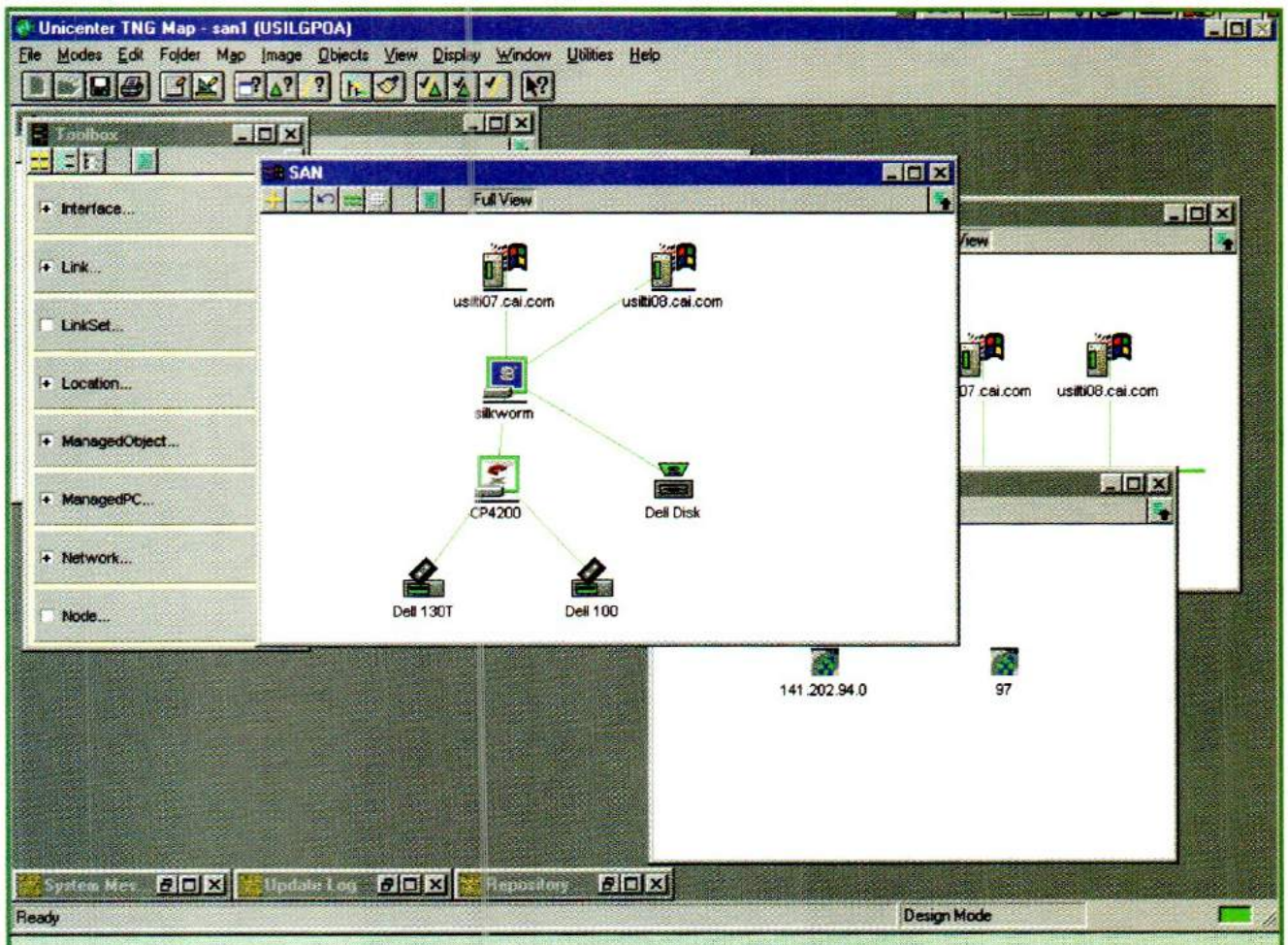
Circle No. 7

but provide a point-in-time image of the data being stored. Data is only copied when the current version begins to deviate from the snapshot.

In July, Compaq released an enhanced version of its StorageWorks Data Replication Manager for remote data replication. The Replication Manager, which currently supports Open VMS and Windows NT and will add support for Tru64 UNIX, Solaris and NT for Alpha by the end of the year, is targeted at financial institutions, banks, telecommunications companies and other large customers with a need for off-site backup capabilities. This new version can back up data over a 40-kilometer connection, instead of the 10 kilometers supported by the previous version.

Storage software is shaping up to be a promising market. According to market research firm Dataquest Inc., San Jose, CA, the worldwide storage management software market will increase from $2.6 billion in 1998 to more than $6.6 billion in 2003. However, Kris Newton, research director for network storage research and consulting firm Strategic Research Corp., Santa Barbara, CA, says that despite the optimistic projections, there aren't many mature storage management applications currently on the market. "There will be huge growth in that market but, for now, storage management products, especially for SANs, are a little slow in coming."

Computer Associates International Inc., Islandia, NY, also made a storage management announcement this summer. In July, the company unveiled its Storage Area Network Integrated Technology Initiative (SANITI). SANITI is an add-on module to the company's Unicenter TNG enterprise systems management framework for UNIX and NT environments. According to Yogesh Gupta, senior vice president of product strategy at Computer Associates, "[SANITI] allows various SAN technologies from heterogeneous vendors to be managed from a single point."



In July, Computer Associates unveiled the Storage Area Network Integrated Technology Initiative (SANITI), an add-on module to its Unicenter TNG enterprise management framework for UNIX and NT, which allows SAN technologies from heterogeneous vendors to be managed from a single point.

Specifically, the TNG framework will now be capable of discovering and managing conventional and SAN-related storage resources such as Fibre Channel hubs, switches and tape libraries on Windows NT, NetWare and UNIX-based networks.

SANITI is the second phase of a three-part SAN road map that began in 1998 with the addition of SAN support for Computer Associates' ARCserveIT storage management software. The third phase, set to take place next year, will add features such as advanced configuration management, policy-based SAN management, SAN failover capabilities and performance/trend analysis to SANITI.

Approximately two dozen vendors have announced their support of SANITI, including Compaq, Dell Computer Corp., Round Rock, TX, EMC Corp., Hopkinton, MA, Exabyte Corp., Boulder, CO, Hewlett-Packard Co., Palo Alto, CA, Hitachi Data Systems Corp., Santa Clara, CA, Legato Systems Inc., Palo Alto, CA, and nStor Technologies Inc., West Palm Beach, FL.

Computer Associates' list of supporters is definitely an asset, says Strategic Research's Newton, because most storage vendors currently have proprietary solutions and because storage standards are still under development. "In this early stage of the market, many people are doing their own thing," Newton says. "We haven't reached a level of complete interoperability, so the more names you can say you interoperate with, the better off you are."–*sjh*

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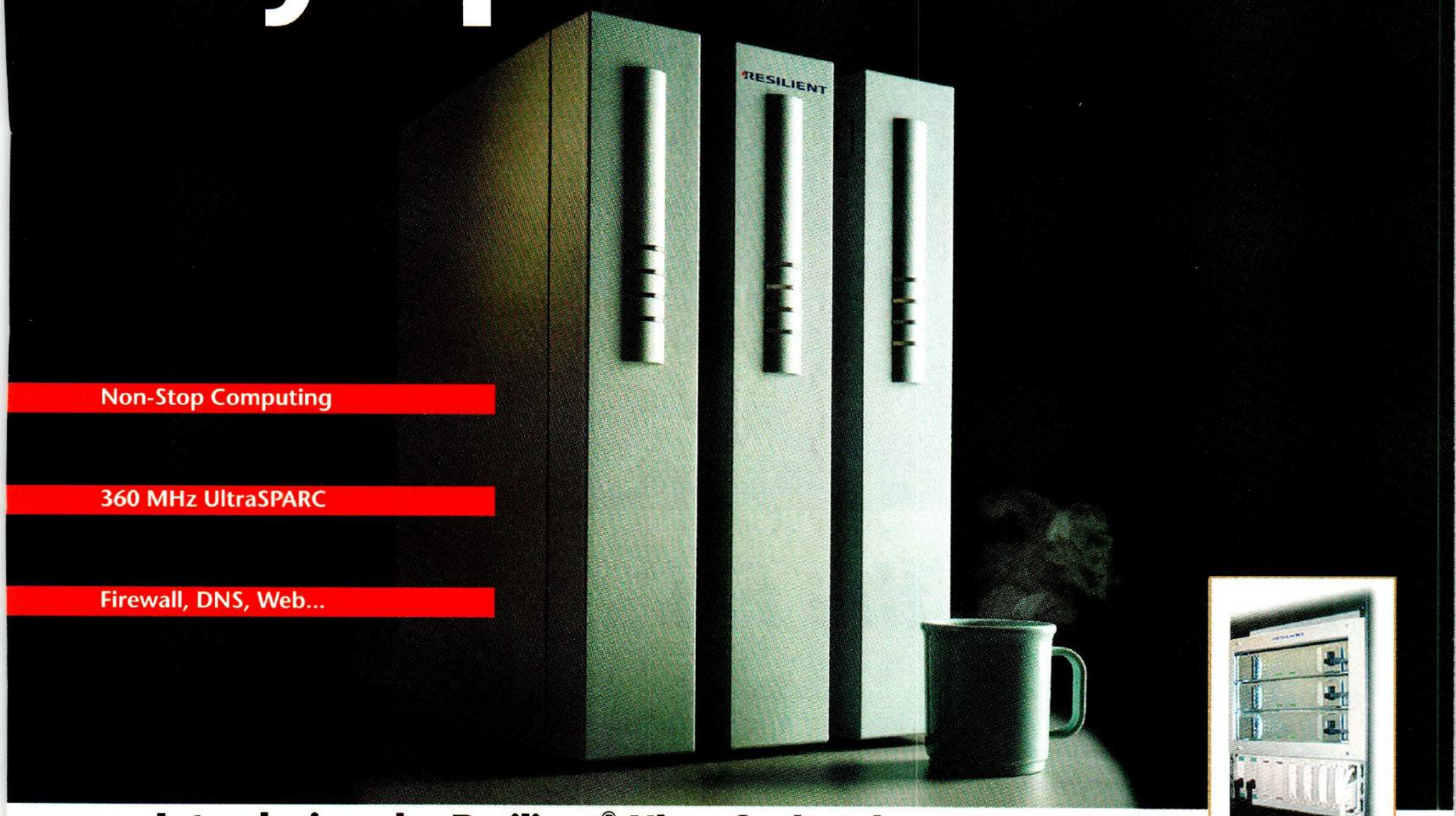

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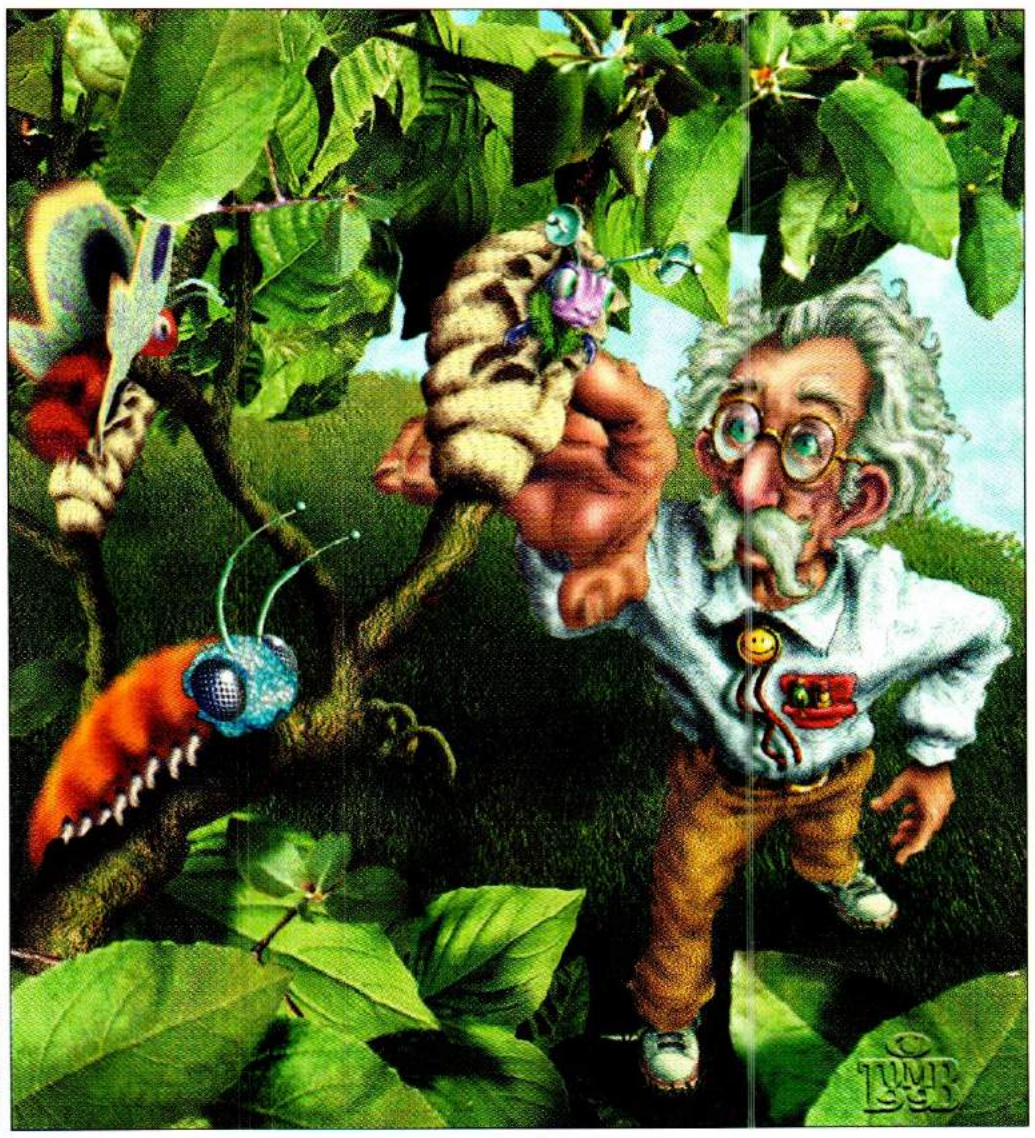
Circle No. 8

Ask Mr. Protocol

by Michael O'Brien



TOM BARRETT

"We don't peer with them."
– The new peers of the realm

"Is that you? I can almost see you!"
– C U Almost See Me

"Roads? Where we're going, we don't need roads."
– *Popular Science*

Mr. P. and the Failure of the Net

Q: *You're always creating blizzards of words about all the things the Internet can do. Listening to you, it sounds as if the Internet is ready to tap dance its way into the next millennium, replacing all current technologies, be they information technologies or otherwise. Do you really believe this?*

A: Mr. Protocol is not particularly glad you asked. He doesn't like being pressed in this area, because he doesn't understand the syndrome. His response is to remain militantly mum.

This needn't stop us.

The Internet is being passed off in some quarters as the greatest invention since fire; mostly by people who haven't read Mr. P.'s maunderings on the slowdown in the rate of fundamentally new inventions during the past 50 years. It supposedly will do everything, a service covering telephony/television/radio/Web/streaming audio/canned audio/streaming video/canned video/canned ham.

To repeat a maxim from a Harvard professor of archaeology, "We've only been building cities for 5,000 years. We're not very good at it yet."

The Internet is barely 20 years old. How optimized can it be?

Let's take a look at a slightly older invention. The telephone took over in a remarkably short space of time and didn't take very long to develop, either. Reasoning by analogy, always a useful pursuit, we therefore should expect the same from the Internet. As there are only a couple of things wrong with this analogy, it must be sound.

The first thing wrong is that the telephone really did take a while to mature. There aren't many people alive today who've ever had to deal with a carbon-granule microphone. Those who have are sort of like those who still remember how to whack the mechanical reed relay (specified over an electronic relay for purposes of high reliability) used in the Host-to-IMP Ready line of the ARPANET. The relay got stuck regularly; so did carbon-granule microphones. The carbon granules kept clumping up in humid weather and you had to give the microphone a good whack to wake them up again. They were in use for a very long time before something better came along.

The other problem is that telephony is, at base, a simple technology. Voices over wires. That's it. Over the years, the technology has been elaborated by the telephone companies. Analog voice signals are now used only in the first and final hops between telephone central offices and actual telephones. Once speech hits the central office switch it is digitized. The digitized speech is routed from switch to switch using a packet protocol suspiciously similar to the Internet stack, called Signaling System 7. This protocol doesn't use any of the same terminology as the Internet stack, and all of the entities therein are special-purpose. This is not an open-ended standard. Every bit of every alternate form of

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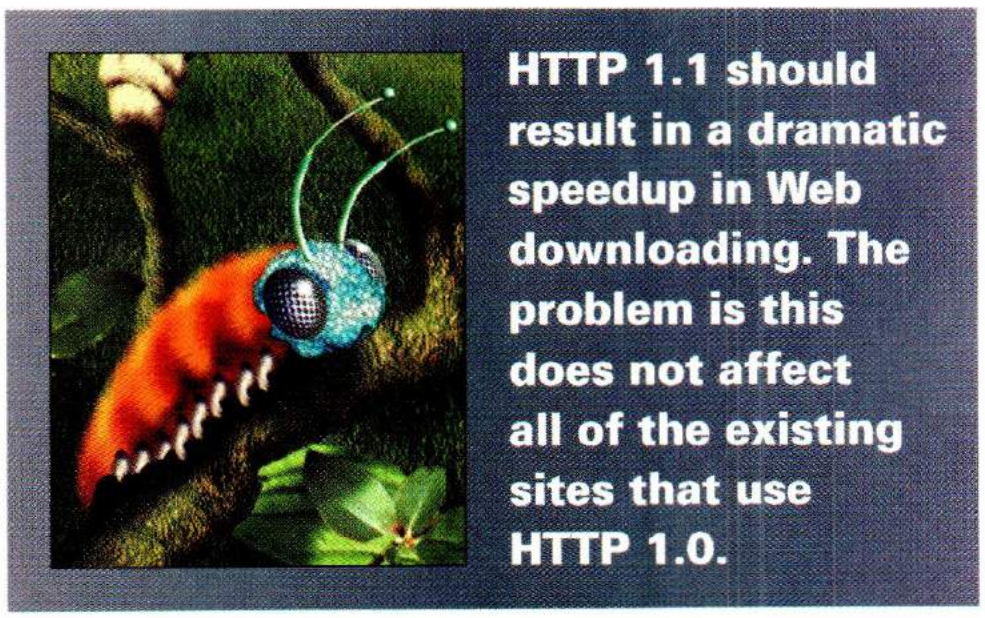
every packet is predefined. No surprises allowed.

Telephony is still being optimized. It was only in the past 20 years or so that long distance calls came up to the same voice quality as local calls, with the advent of the "electronic switch." The electronic switch is a special-purpose computer, but it's called an electronic switch because telephone systems designers want everything to sound like it was their idea. That's why the phone wires in your house have names like "tip," "ring" and "sleeve," although these are actually names for the anatomy of a telephone operator's plug circa 1910. They can't just call them "red," "green" and "white," partly because that would be too easy, like anybody could do it, and partly because the chowderheads who hook these things up at the network block outside your house like to play games and reverse the wires, or use brown, black, blue and white-with-stripey-orange when they get bored. Helpful Household Hint Number 110: If you don't hear the touch-tones when you press the buttons, reverse the red and green wires.


HTTP 1.1 should result in a dramatic speedup in Web downloading. The problem is this does not affect all of the existing sites that use HTTP 1.0.

Nouveau techno types who get ISDN lines can brag about how their voices are digitized directly by the phone, but let's face it, phone companies are still all wound around the post carrying voice signals, and put the Byzantine Empire to shame for complexity when you try to talk about carrying data. If your company has any size to it, you have to hire people called "telecommunications experts" just to talk to the dang phone company, and while half the time they act like the phone company pays them and you don't, the other half of the time they sound just like your lawyers and say "Oh no you don't!" a lot.

This is what you get after 100 years of evolution. The Internet's only 20. Be afraid.

History Repeats Itself

The first service ever defined on the ARPANET was Telnet. This protocol allowed a local user to type at a remote computer as if he had a local connection. It sent keypresses either one character at a time or one line at a time, depending on the mindset of the remote host, and displayed the (usually voluminous–some things don't change) information coming back. It did this over a persistent connection, which lasted as long as the session. Telnet's still around today, but is much less used because the computational model it supported is now history. There are no terminals, and the computers at which people type are now local, not remote.

Now we've got the Web, where your local computer runs a browser, and you type a few things at it and a voluminous amount of information comes back…I'm sorry, I'm repeating myself, must be old age.

See the resemblance? But it is now handled differently under the hood. Each URL hyperlink that's clicked on opens a separate connection to the distant Web server. And, in the page that comes back, every image, every form, every little graphic bauble causes a new, separate connection to be opened to download it, a connection that's immediately closed again.

Frankly, if anyone had pulled doo-doo like that on a host 10 years ago, it would have been regarded as a denial-of-service attack.

This is only the most severe mismatch between Internet services and the underlying technology. The World Wide Web Consortium (W3C) recently issued the specifications for HTTP 1.1, which allows and encourages browsers to maintain persistent connections with Web servers. This single change should result in a dramatic speedup in Web downloading. The problem is this does not affect all of the existing sites that use HTTP 1.0. Also, some sites are already reporting that they speak HTTP 1.1, even though the specification has only just been released. What the sites actually speak ranges from "real" 1.1 to some earlier drafts of 1.1, all the way down to pure 1.0-but-lying-about-it-for-propaganda-purposes.

At a higher level, HTML has its own problems. It's fragmented, as vendors vie for market share by implementing vendor-specific "extensions." Worse, although it was originally intended to be a document description language in which browsers were responsible for the final layout, it has been dragooned into something closer to PostScript, as content providers try to nail down exactly what a page is going to look like so that all their fancy graphics will look right. This hasn't been good for the integrity of the specification at all.

Meanwhile, down at lower levels, the Internet is busting its britches. The most common routing protocol used at the IP level is Border Gateway Protocol 4th Edition (BGP4). Under this specification, routers maintain routing tables for all the active networks. As the Internet grows, so do these routing tables. Matters are made somewhat worse by the existence of "peering agreements" between the top-level Internet backbone companies. They don't allow BGP4 to determine their routes. Instead, they make specific agreements with other backbone providers and build up their top-level routing tables entirely by hand, cross-charging by the megabyte.

A process called "route aggregation" has been created by determined people to alleviate this problem. Under route aggregation, network numbers are handed out in such a way that entire networks can be subsumed under an artificial higher level network, which includes all the network numbers of the aggregated nets. Politically, this "supernet" doesn't exist, but from a routing standpoint it works fine. This has helped greatly in keeping routing tables shorter than they would be, but it's a hack, not a solution. (It's a very good hack, though.)

The need for more address space has resulted in the next

generation of IP, IP Version 6 (IPv6). IPv6 has 128-bit addresses instead of the 32 bits in the current version, IPv4. How to route 128-bit addresses in a scaleable fashion is a current topic of research. Doesn't that give you a warm feeling?

Mr. Protocol, of course, addresses these things tangentially. He's all in favor of HTTP 1.1, IPv6, or any other new spec that looks well designed and solves a protocol problem. However, he refuses to address the question of legacy software, mostly because he never uses it. He has a 384-GB hard drive on his computer, which multiboots Windows 3.1/95/98/NT, Windows NT Server, Windows NT Workstation, Windows 2000 beta, FreeBSD, NetBSD, OpenBSD, Sprite, all six Linux distributions and BeOS. His disk is full. Almost 90% of it is dead code that isn't used but is hanging around from some preupgrade state, impossible to discern from running code based on inspection. He doesn't care. He backs it up to a WORM drive jukebox and then uses the extra CDs for cat Frisbees. He has every version of Netscape back to Mozilla (no version of Internet Explorer because the court case confuses him) and never uses any of them. He speaks raw HTTP via Telnet and reads raw HTML as it comes back. It's very scary. Browser wars just don't affect him. He gets a big giggle out of the `INDEX` tags that users never see, inserted to fool Web crawlers into thinking the page is the most important thing since the *Baghavadgita*. He reads these to me over breakfast. No. Actually, he doesn't. He memorizes them and recites them to me over breakfast. What he does not do is pay attention to the politics of Internet standards.

Gradually, those politics are coming home to roost. Originally, keeping the Internet running was volunteer work. Now, it's very much for-profit work, and services that used to be run by volunteers are now being claimed as war prizes by corporations with a piratical bent. The worst area right now is the successor to the Internet Assigned Numbers Authority (IANA), a new not-for-profit corporation known as the Internet Corporation for Assigned Names and Numbers (ICANN). This is a very peculiar war, because it amounts to a struggle for hearts and minds more than it does a courtroom fight or business competition.

No one claims absolute jurisdiction over the Internet. The U.S. government occasionally tries, as in this case, but doesn't press the case at a very high level because it's a fight it can't win. Prevailing legally would first require a court of jurisdiction, which is pretty darned tricky, and anyway would result in a corporate war that would cause significant loss of value of the Internet.

And in the case of ICANN, it amounts to a war over root servers. It is possible for anyone to mount an attempt to preempt the root Domain Name System (DNS) servers, simply by advertising their own root server. The trick is to get people to use it. This is exactly what has been tried in the war over ICANN, and it didn't work. The backbone providers ignored them, and their vote is just about the only one that counts.

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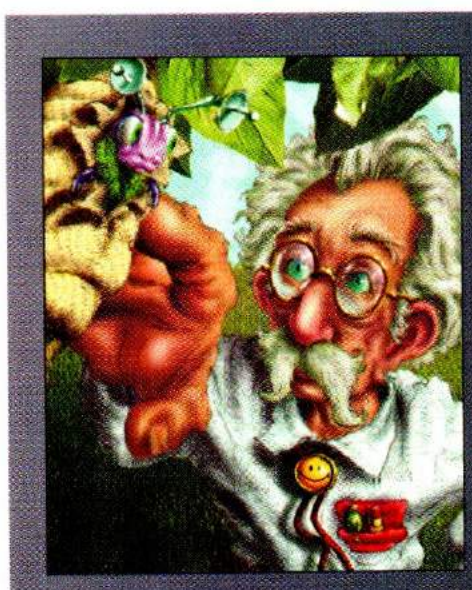
Ask Mr. Protocol

All this war over assigned DNS domains. And this is an area which, unlike IP address space, is infinitely extensible. The scarcity of names in .com is artificial. In fact, .com itself is artificial.

Perhaps most damning is the failure of something at which the Internet ought to shine. Despite the lack of deployment of any real quality-of-service technology necessary on a congested Internet to allow smooth audio and video streaming, the Internet is still able to transmit live audio and video fairly well. It ought to be able to take at least some of the load off of the extremely expensive, extremely special-purpose corporate videoconferencing centers.

Yet, a recent article in *Wired* magazine points out that there is a large, healthy (if you can call it that) culture of "hyperfliers," people who fly more than 100,000 miles per year, almost always to attend business meetings. They won't use videoconferencing, Internet-based or otherwise.



The problems won't go away, they'll be supplanted by new ones. We'll wish for the good old days. Really! These are the good old days. Enjoy 'em while you got 'em.

You'd think things would be better than that. It costs a lot to build a video teleconference center, and all it does is transmit live pictures and sound over a bundle of about 10 ISDN lines. The Internet could embed this in an arbitrarily complex full-service conferencing system with shared whiteboards, document editing and a whole bunch of stuff that's even snazzier than what real people in a real room could have. The Internet has done this. And the hyperfliers are still up there, fighting chronic fatigue and knee pain, wondering if that next Scotch will prevent them from successfully getting off the plane when they land. What a failure!

The list of reasons is as long as your arm, having to do with a lot of psychological issues of presence–people tend to watch the video screens and not the people in the same room–and other things. But if people will put themselves through 100,000 miles of torture per year rather than use the Internet, then there just might be a sign there that a bet has been missed.

So what have we got?

- The Web is a killer app all right. It's killing the Net.
- Even in its unkilled state, the Net doesn't yet support audio or video very well.
- People would rather fly 3 million miles per year than use the Internet to hold meetings.
- Yuck.

One thing Mr. Protocol does not shrink from is prognostication. Large parts of the so-called real world are just missing from his horizon, so the rest seems so much simpler. Let's see what he thinks the outcome is going to be.

First, this will all settle out. The problems won't go away, they'll be supplanted by new ones. We'll wish for the good old days. Really! These are the good old days. Enjoy 'em while you've got 'em. It's already too late for the Australians, who have just given away the store by allowing their government to force providers to regulate content. The time will come when just about everyone has been weaseled into that position, U.S. First Amendment notwithstanding. It's what governments do: govern.

Second, bandwidths will increase in smaller increments than services. Bandwidth is a combination of engineering and marketing, but it represents a commodity that is well understood by the consumer, is greatly desired, has a clear path to manufacture and will sell itself. On the other hand, each new ballyhooed "service" is really just Web stuff by another name. E-commerce is a strong contender, but even it is still all Web-based. The Web paradigm is already starting to show strain. Eventually, someone will think of something truly new to do, like real telepresence, and then everyone will meet in places that resemble the bar in Neal Stephenson's novel *Snow Crash*. Most heavy Internet users of Mr. Protocol's acquaintance practically lose bladder control at the thought. They want in that bar so badly they can taste it, never mind the fact that in reality most of them wouldn't go near a place that sleazy and dangerous on a bet. Only then will they discover (surprise!) that everyone in the bar is just as mind-numbingly boring as the people they meet in real life, only this bunch costs a lot more in connect time to hang out with, and smells worse.

This will not stop it from being wildly popular. No way.

Third, the timeline on this is very elastic. By and large, people's desires don't change. For 60 years or so, *Popular Science* has been printing covers with personal fliers, and they haven't happened yet. They're the only obvious solution to highway congestion, but no one's figured them out. On the other hand, all the carpool and public transit incentives have reached a dead end: The people willing to give up personal transportation have already done so. Eventually, someone will figure it out. Ditto the Internet.

The only hyperfliers still in the air will be the masochists who like it up there. ⊸

Mike O'Brien *has been noodling around the UNIX world for far too long a time. He knows he started out with UNIX Research Version 5 (not System V, he hastens to point out), but forgets the year. He thinks it was around 1975 or so.*

He founded and ran the first nationwide UNIX Users Group Software Distribution Center. He worked at Rand during the glory days of the Rand editor and the MH mail system, helped build CSNET (first at Rand and later at BBN Labs Inc.) and is now working at an aerospace research corporation.

Mr. Protocol *refuses to divulge his qualifications and may, in fact, have none whatsoever. His email address is* amp@cpg.com.

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Circle No. 11

by Peter Collinson, Hillside Systems

PAUL SCHULENBURG

Small Text Databases

My brother-in-law died suddenly in February. He had no partner and so we've been unexpectedly stuck with the task of getting his affairs in order. He was in love with railways, and spent much of his spare time traveling around the United Kingdom and Ireland on the many pairs of iron tracks that exist in these islands. His house is stuffed with books about railways, so I decided to create a catalog of these tomes that we can send to second-hand booksellers.

The first rule of any such project is to see what exists on your systems that may provide an "off-the-shelf" solution. On UNIX, there is a database mechanism accessed by `refer` that is intended to provide citations to papers. It enables authors to access a central database to find the full details of a particular paper. The system allows a citation to be automatically included in the `nroff` source of the paper or book the author is writing. This system is bendable for other uses, such as address lists, but it wasn't a good fit for my project. I decided to start from scratch.

The first problem with such a project is data capture. I phoned a second-hand bookseller and asked what information he required. He said he needed the title, author and publisher. I decided to add the ISBN. I had to make a second pass over the books when another bookseller said he needed to know whether the book was bound with a hard or soft cover, since this is important pricing information. It turns out that the second-hand market doesn't use the ISBN at all.

I now had an idea of the data to be captured and I knew that I was going to process the data using the standard set of UNIX tools. What next?

UNIX deals with text databases pretty well but, in general, a "standard" database contains one record per line, with the fields within the records separated by a unique character. It can be very error-prone to create this kind of file by hand with a text editor, it's not always clear which field you are entering.

Creating such a database is best done with a data entry script that prompts you for the contents of a specific field and allows you to enter the data for that field. When the script terminates, the complete record can be written. However, mistakes will inevitably be made in data entry. Errors are usually spotted after you've hit Return to terminate the input of a specific field. So it's prudent to build editing capabilities into this type of script.

I decided that because I was going to be doing the data entry, I could use a text editor. I would simply create a text file that consists of records separated by blank lines. Each field in the record starts with some identifiable text that acts as a prompt and a tag for the data. I'd worry about creating the UNIX single-line record file later. I created a template file:

```
Title:
Author:
Publisher:
ISBN:
Cover: H
```

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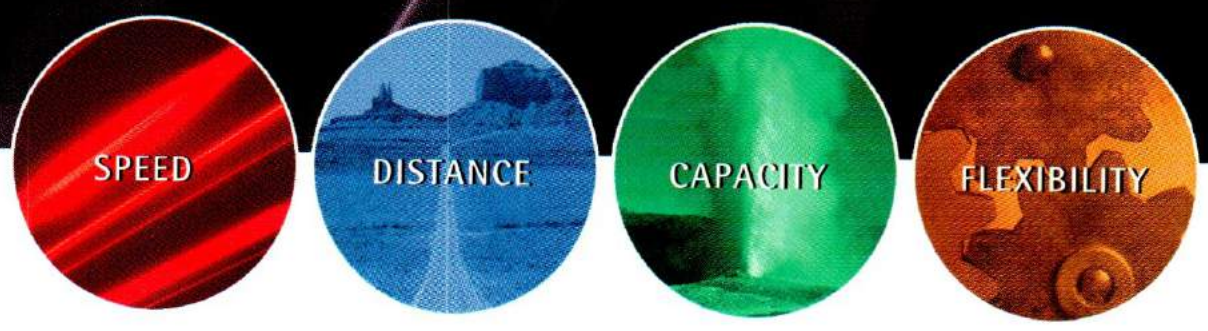

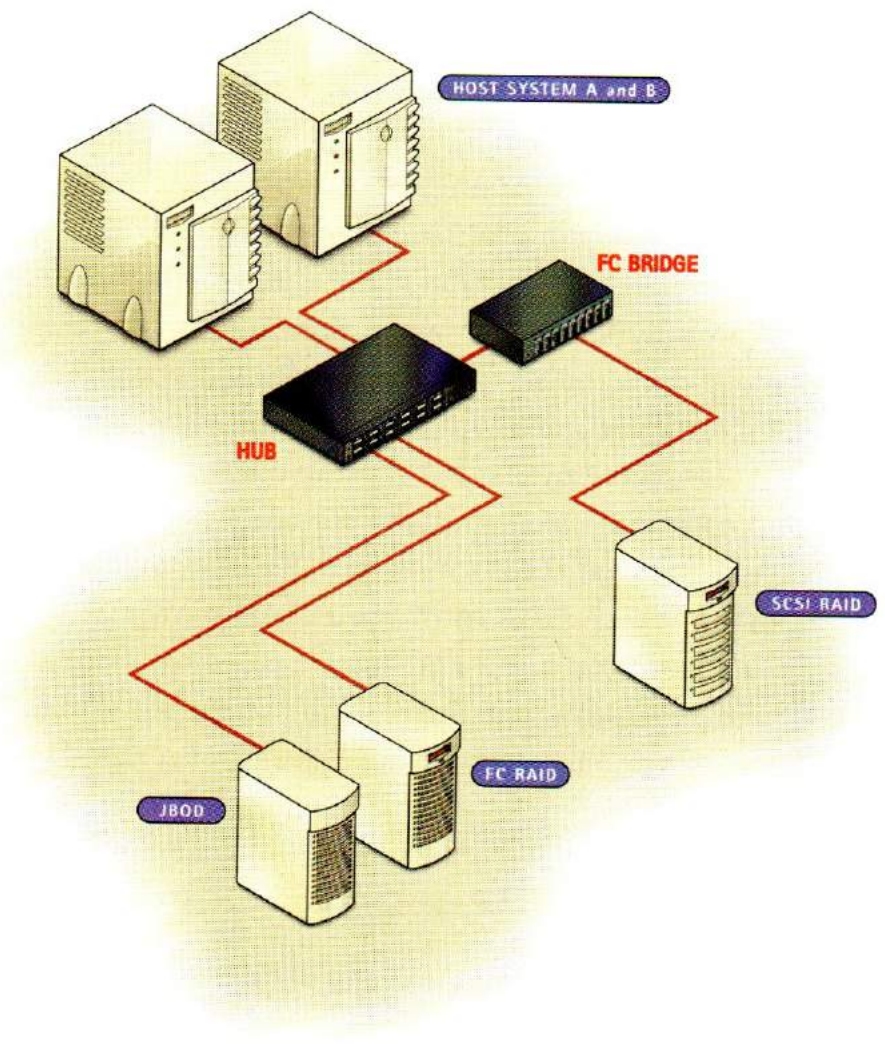

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Circle No. 12

(Incidentally, I like to put a single space after the initial colon because the file then looks tidier.) I spent some time communing with GNU emacs (which I am beginning to use after a delay of many years) and taught it to copy the last record in the file, clearing the "ISBN" field and resetting the "Cover" field. I created a new record from the last one by typing a chorded keystroke, which also positioned the cursor at the start of the data in the "Title" field. I also convinced emacs that the Tab key should position the text cursor in the next field down, placed just after the colon and character space that exists on the line.

Three long days, 1,200 miles of driving and 850 books later, I had a catalog of the books.

Cleaning the Data

The next stage is to check the data is clean. I want to make sure only a single blank line separates each record and there is no trailing white space (tabs or spaces) in the file that might get in the way of processing. I'd also like to make sure each record has the correct number of fields. I am fairly confident the fields are in the correct order, but checking that I have five fields per record tells me that two records have not been joined together by simply omitting the blank line acting as a separator.

One temptation with this type of job is to simply hack on the source files using an editor, because it's a one-off task. Well, one-off tasks are usually done at least twice and sometimes a few more times than that, so I generally feel it's worthwhile to create a small script that does the task for you. The script can then be reused when that one-off job needs to be redone.

Perl is actually very good at this kind of cleanup operation; you can read the whole file into one string and then apply a couple of pattern-matching commands to clean the file. If you don't have access to Perl, or want to use the standard UNIX tools, then you'll probably end up creating a shell script that uses sed and awk. The scripts below assume you are using either the Bourne shell (sh), Korn shell (ksh) or GNU's Bourne-again shell (bash).

To clean the spaces from the file, I tend to use sed:

```
sed -e 's/[<SP><TAB>]*$//' file > newfile
```

(You should replace <SP> with a real character space and <TAB> with a real tab character.) The sed command reads the file one line at a time, performing the substitute command on each line. The new text field at the end of the s command is empty, so the command looks for either a space or a tab ([<SP><TAB>]) repeated several times (*) until the end of the line is reached ($) and will delete any matched data that is found.

Incidentally, some shells won't allow you to type a tab character into an interactive invocation because it is used for file name completion. I'm assuming that the commands are being typed into a file and then executed. When using small command files for complex sed and awk programs, I'll often place the commands into a shell variable:

```
sedprog='s/[<SP><TAB>]*$//'
sed -e "$sedprog" file > newfile
```

which means you can split the command invocation from the command specification. The double quotes around $sedprog are important.

Dealing with Blank Lines

Getting rid of trailing spaces is easy. But how do we compress multiple empty lines into a single empty line signifying the end of the record? Well, to be frank, I was stumped by this. The sed manual page for Solaris contains a lengthy example of multiple-line suppression, but I was convinced there should be a better way. I decided to use awk:

```
oneblank='BEGIN {  blanks=0  }
/^$/  {  blanks++; next;  }
      {  if (blanks != 0) printf "\n";
         blanks = 0;
         print $0;
      }
END   { printf "\n";  }'
awk "$oneblank" file
```

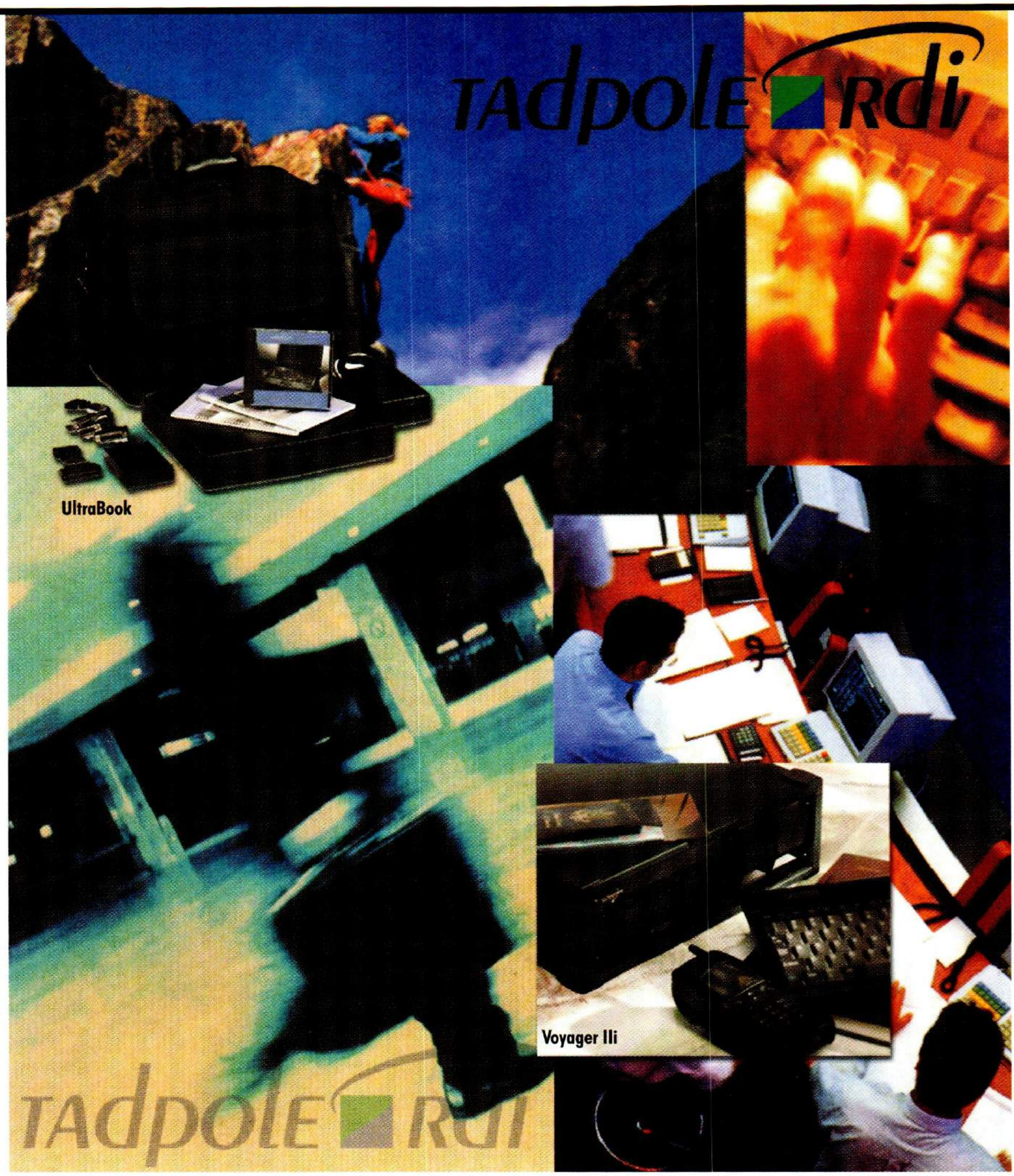
If you have not come across awk before, then this might frighten you. However, it's quite easy to understand. Honest. The awk command earns its living by reading a data file one line at a time and applying a program to each line. The awk program can consist of several lines, each starting with a pattern, followed by a set of statements in curly braces. The statements are executed if the pattern matches the line that has just been read. BEGIN and END are special patterns that are executed just before a program is run and just after, respectively.

Our program above looks for empty lines using the standard regular expression idiom of /^$/. When empty lines are found, we count them by incrementing the blanks variable, which we carefully set to zero when the program starts. Actually, presetting the variable isn't strictly needed because awk ensures that variables start with a zero value. However, it's good practice in other languages that don't act in such a benign way, and so I tend to include the statement.

After we've incremented the blanks variable, we invoke the next statement, which skips to the end of the script, reads the next line from the input and starts processing it. If we didn't use next, then the remainder of the script would be applied to all empty lines because the next chunk of script has no selection pattern.

With no pattern, silence gives consent and the next code section in the curly braces will be executed for every non-blank input line.

First, we look to see if any blank lines have been found; if so, we print a single newline to create an end-of-record indicator. We have to use the formatted print statement printf to force the output of a single newline. Not forgetting to reset the blank counter to zero, we print the whole input line. The magic $0 variable in awk contains the entire



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Circle No. 13

line that is being processed at that point.

Finally, we cope with one of the two difficult boundary conditions: the end of the file. We'd like to ensure that a blank line terminates the last record in the file, so that an end-of-record marker is placed at the end of the file. Making sure that the last line is blank is easy: We print a newline character at the end of the file.

The other boundary condition we have to think about is what happens at the start of the file. If the original file starts with one or more blank lines, then our processed version will start with one. This will be inconvenient. However, this condition is easy to establish, we simply check that the source file begins with the text that is the start of the first record.

Notice that the awk script is relying on the result of the previous space-stripping script; we know that blank lines really are empty and don't contain any invisible white space. Also, we don't actually need to count blank lines. We could use a switch, setting `blanks` to one when we find a blank line.

We have one further piece of checking to do. We would like to ensure that each record contains exactly five lines. Because we are stepping through the file in the script above, it seems natural to extend the script to do that. When we find a blank line, we can check that it has been preceded by five active lines:

```
oneblank='BEGIN  {  blanks=0; rct = 0 }
/^$/  {  if (rct != 0 && rct != 5) {
             printf "Record length error \
              at line %d\n", NR > "/dev/tty"
         }
         rct = 0;
         blanks++; next;
      }
      {  if (blanks != 0) printf "\n";
         blanks = 0;
         rct++;
         print $0;
      }
END   {  printf "\n";  }'
awk "$oneblank" file
```

Although this may seem complex, there is actually very little here that's new. I am using the `rct` variable to count the number of lines in each record, in precisely the same way I used `blanks` to count the number of blank lines. I check the value of `rct`. If it holds five, then all is well. If its value is zero, then we are processing a second or third blank line, and again all is well.

If `rct` contains any other value, then we have a problem and print an error message. The formatted print statement will output the string replacing `%d` with the value of the `NR` variable. The `NR` variable is maintained by awk and holds the number of records processed to date. This invocation of awk is treating each input line as a record, so `NR` contains the line

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number in the source file. We can use this line number to find and fix any problem in the source file. Incidentally, I've split the argument string for the `printf` statement for printing. You should join the lines together if you want to try out this script; as it stands `awk` will complain.

There's one other piece of magic. I am printing the error message to the user's terminal (`> "/dev/tty"`) rather than to the output file. This ensures the user will see this error message, and it won't be simply added to the output file causing further confusion.

Creating a Single-Line Record

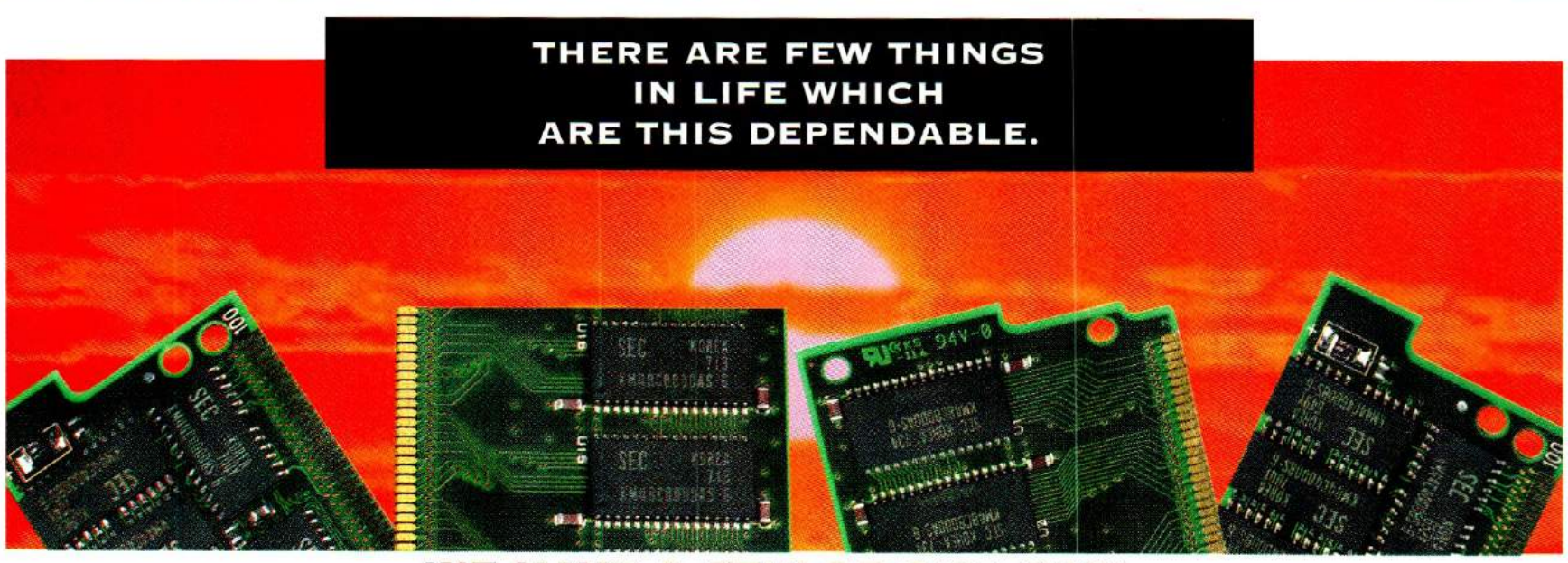
We can now guarantee that we have clean data. The file can be processed to remove trailing spaces, and we can check that each record contains five lines. So all the inconsistencies that may have been introduced by originating the file with a text editor can be eliminated. We can now move to the next stage of removing the prompts from the file and compressing each record onto a single line. We'll need to identify a character that doesn't appear in the data to act as a field separator. I'm using the vertical bar character in the examples below.

To join together each of the lines in the data, we tell `awk` that it should use a specific record and field separator. You can do this from the command line, but I am doing it at the start of the `awk` program itself:

```
combine='BEGIN { FS="0; RS="" }
      { printf "%s|%s|%s|%s|%s\n",
       $1,$2,$3,$4,$5
      }'
```

Again, I've wrapped the line for printing. The first line of this script sets the field separator to the end of each line, shown by the newline character. Because of this setting, `awk` will see an empty line as a null string, and we set the end-of-record marker to the null string to show this. When this script is run, `awk` will separate the file records using the blank line that we have carefully created as the end of the record, and each line before that will form a field in the record, addressed in turn by the `$1...$5` syntax. I hope now you understand my concern with ensuring that the file ended in a blank line; otherwise, `awk` will not have seen an end-of-record indicator for the last record on the file.

At the end of every record, `awk` will print a single line, where the five lines or fields in the record are joined into one, each separated by a vertical bar character. The `%s` character in



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Circle No. 16

the formatted print statement tells `printf` to print a string.

Are we done? No. There is one final step. We must remove the prompts from the data. Running the scripts above on the template file will give us a single record that looks like this:

```
Title:|Author:|Publisher:|ISBN:|Cover: H
```

We no longer need these prompts because we are now deducing the meaning of a field by the position of that field in the record. Deleting this prompt information is a job for `sed`:

```
delprompt='s/\|[a-zA-Z]*:[ ]*/|/g
   s/^[a-zA-Z]*:[ ]*//'
```

Again this may seem a little scary, but it's easy really. The first editing statement does the bulk of the work. We use the substitute command to look for a regular expression and replace it with new text. We use the vertical bar to "anchor" the search; essentially, we look along the line for a vertical bar, a word, a colon and an optional space, and when it is found, we replace what we have matched with a vertical bar.

The elements to be matched are as follows:

`\|` – A vertical bar. This needs escaping because the vertical bar character is interpreted as "alternate expression" by `sed`'s regular expression parser.

`[a-zA-Z]*` – A word, which is either "a to z" or "A to Z," repeated as many times as we need it.

`:` – A colon.

`[ ]*` – An optional space. Actually, the square brackets are not needed, but they make the space stand out as being something significant, so I often write a specific space character like this in regular expressions. The star (`*`) means that a match will be made when we find a space repeated zero or more times; so this idiom matches nothing, or one or more spaces.

Note that the word match above will also match nothing. I've paid no attention to dealing with this problem, because I know the prompt is always there in my source data.

The `g` at the end of the first expression tells `sed` to repeat this operation along the line until no further matches are found. The second command to `sed` picks up and deletes the `Title:` entry that appears at the start of each line; because there is no vertical bar at the start of the line, the first statement won't match. We use the caret anchor (`^`) here to mean the start of the line.

Well, that all looks good, so we can now combine all the various stages together in one pipeline:

```
sed -e "$sedprog" |
awk "$oneblank" |
awk "$combine" |
sed -e "$delprompt"
```

If we place this in a file called `cleanfile`, we can then say

```
sh cleanfile < booklist > booksingle
```

What Next?

Well, the data is now in a form that's accessible by a range of UNIX tools. We can print it using `troff` (or `groff`) by inserting the data into a file and inserting it into the following:

```
.TS
tab(|);
l l l l l.
<insert data here>
.TE
```

The `.TS` and `.TE` macros are used by the `tbl` program to generate a table. Actually, it's somewhat more complicated than this, so get help if you are not up to speed on `troff`.

We probably want to sort the data before printing it, and the `sort` command can deal with the output file simply. For example,

```
$ sort -t '|' booksingle
```

will use the vertical bar as a field separator, and sort using the fields left to right. The vertical bar needs quoting to get it past the shell. I wanted to sort the file into publisher, then title and author order, and had to use a more complicated `sort` command:

```
$ sh cleanfile < booklist |
     sort -t '|' +2 -3 +0 -2
```

The above command tells the `sort` program to order first by the Publisher field, then by Title and then by Author. It's easiest to think that numbers refer to the separators between the fields:

```
0   1    2      3
 Title|Author|Publisher|ISBN
```

So `+2` says "start ordering after separator 2" and `-3` means "stop ordering after separator 3." We are sorting alphabetically depending on the Publisher field. If the Publisher fields are equal, we start ordering again after (notional) separator 0 and stop after separator 2, so we then sort by Title and then Author.

Further Reading

I've used *sed & awk* by Dale Dougherty and Arnold Robbins (published by O'Reilly and Associates Inc., Second Edition, March 1997, ISBN 1-56592-225-5) as source material for this article. I have the first edition, but the book is now in its second edition. ⊸

Peter Collinson *runs his own UNIX consultancy, dedicated to earning enough money to allow him to pursue his own interests: doing whatever, whenever, wherever... He writes, teaches, consults and programs using Solaris running on a SPARCstation 2. Email:* `pc@cpg.com`.

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Circle No. 15

Listing 1. mkfifo

```
1   #!/usr/local/bin/perl -w
2   # $ID: mkfifo,v 1.1 1999/07/05 19:12:28 jsh Exp jsh $

3   use strict;
4   use POSIX "mkfifo";
5   use Getopt::Std;
6   use vars qw($opt_m);

7   $0 =~ s(.*/)();
8   my $usage = "usage: $0 [-m mode] filename ...\n";
9   getopts('m:') and @ARGV or die $usage;

10  my $default_mode = 0666;
11  $default_mode &= ~(umask 0);

12  sub sym_perms {
13    my $sym = shift;
14    my $mode = $default_mode;

15    my %who = (u => 0700, g => 0070, o => 0007);
16    my %what = (r => 0444, w => 0222, x => 0111);

17    my ($who, $how, $what) = split /([+-=])/, $sym;
18    $who =~ s/a/ugo/g;

19    my @who = split //, $who;
20    my $who_mask = 0;
21    foreach (@who) {
22      $who_mask |= $who{$_};
23    }

24    my @what = split //, $what;
25    my $what_mask = 0;
26    foreach (@what) {
27      $what_mask |= $what{$_};
28    }

29  #printf "%o, %o, %o\n", $who_mask, $what_mask, $change;
30  #print "$how\n";

31    if ($how eq '+') {
32      $mode |= ($who_mask & $what_mask);
33    } elsif ($how eq '-') {
34      $mode &= ~($who_mask & $what_mask);
35    } elsif ($how eq '=') {
36      $mode = ($mode & ~$who_mask) | ($who_mask & $what_mask);
37    }
38  }

39  sub get_mode {
40    my $mode = shift;
41    my $real_mode;

42    if ($mode =~ /^0?[0-7]3$/) {
43      return $real_mode = oct($mode);
44    }
45    $real_mode = sym_perms $mode;
46    return $real_mode unless $real_mode < 0;
47    die "bad mode: $mode\n";
48  }
```

Continued on Page 36

Being part of the file system meant fifos incorporated the best of both worlds: unrelated processes could use them to pass large volumes of data back and forth without requiring disk activity or space. The system call required to create a fifo has varied over the years, but the POSIX version is `mkfifo(const char *path, mode_t mode)`.

mkfifo(1)

There are, however, not one but two POSIX `mkfifo` interfaces: the POSIX.1 interface and the POSIX.2 utility, which lets you create a fifo from the command line. Its syntax is trivially different:

```
mkfifo [-m mode] filename ...
```

With this command, you can create an IPC channel between unrelated processes at the shell level–well, at least on POSIX.2-conforming systems. What do you do with crippled, antiquated, non-POSIX.2-conforming UNIX systems? Or newer operating systems designed to be crippled and antiquated, like Windows NT? One possibility is to use a `mkfifo` from a tool kit like one of the ones we described last month (see "Software Ptools," August 1999, Page 39, `http://sw.expert.com/C9/SE.C9.AUG.99.pdf`).

When we looked on the Web for a copy of `mkfifo`, we couldn't find one. This was good and bad news: bad news because we wanted it, good news because it gave us a chance to write it and then donate it to Tom Christiansen's pile of free UNIX utilities written in Perl (for the current list, see `http://language.perl.com/ppt`).

Here, then, is our implementation of `mkfifo` (see Listing 1), followed by a dramatic reading.

Scattered about is some boilerplate professionalism. We'll skim over it first for two reasons: 1) getting it out of the way is easy; and 2) it reflects how we write our code. We start by writing these parts first, stubbing out the core functionality of the program. While we're getting these parts right, we have time to think about the hard stuff.

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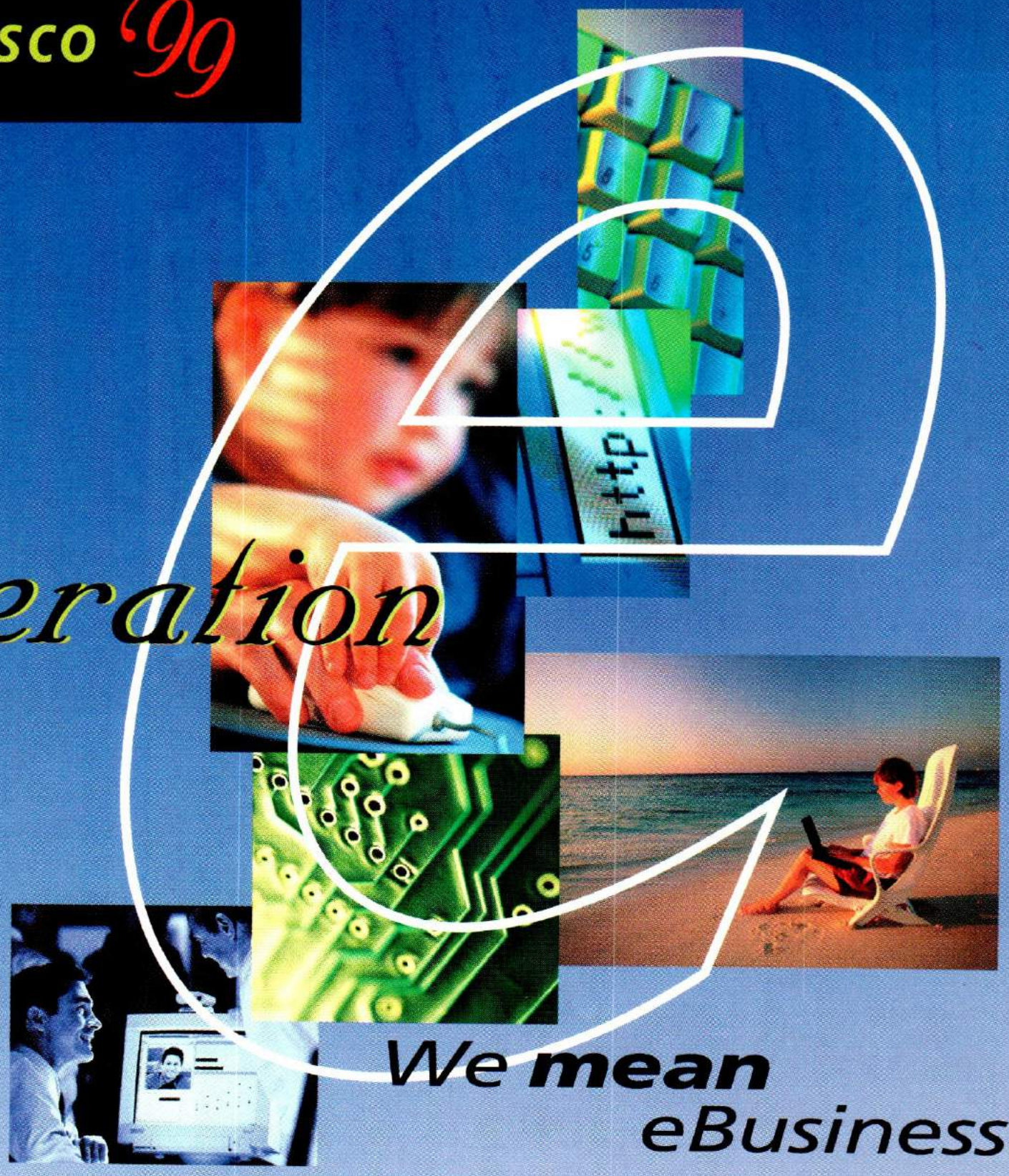

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```
49  my $mode = $opt_m ? get_mode $opt_m : $default_mode;

50  foreach my $fifo (@ARGV) {
51    mkfifo $fifo, $mode or die "can't make fifo $fifo: $!\n";
52  }

53  =head1 NAME

54  mkfifo - make named pipes

55  =head1 SYNOPSIS

56  mkfifo "-m mode" filename ...

57  =head1 DESCRIPTION

58  =over 2

59  Create one or more named pipes, in the order specified,
60  with the mode given.

61  If no mode is given, create them with mode 0666,
62  modified by the umask.

63  =back

64  =head1 OPTIONS AND ARGUMENTS

65  =over 8

66  =item I<-m>

67  The mode the fifo should be created with.

68  Numbers must be three octal digits (as for B<chmod(1)>.

69  Symbolic modes, specified the way you can for B<chmod(1)>
70  (such as C<g+w>) are also acceptable.

71  =item I<filename ...>

72  One or more fifo names to create

73  =back

74  =head1 AUTHOR

75  Jeffrey S. Haemer and Louis Krupp

76  =head1 SEE ALSO

77    chmod(1) umask(1) mkfifo(2)

78  =cut
```

In any case, the boilerplate contains the following: Line 1 is the shebang line that invokes the interpreter with the usually useful `-w` (whine copiously) option, which warns of common programming mistakes. We make a lot of mistakes, so line 3 is the `use strict` pragma, which is even more whiny than `-w`.

Line 2 is the RCS ID. Revision Control System (RCS) is our safety net. It lets us make major modifications to working (or almost-working) versions without having to worry that we'll forget exactly what we changed if our "great new idea" doesn't pan out the way we'd imagined.

Lines 53 through 78 are documentation. What? We actually write documentation? Well, yes. Writing man pages for everything keeps us from having to decide whether or not we need to. We're not done until it has a man page.

Lines 7 through 9 are argument processing. The call to `getopts('m:')` from the `Getopt::Std` module on line 5 says that our command will take one optional argument `-m`. The colon announces that the option demands an argument. After a successful call to `getopts()`, the value of that argument will be in the variable `$opt_m`, which we declare on line 6 to keep `use strict` from whining.

If the call to `getopts()` fails, we die with a usage message; this is better than the boring `Unknown option` message issued by `getopts()` itself, because it tells users what they *should* do. In fact, lines 7 and 8 arrange to issue the same usage message for all improper invocations. If you're a Perl beginner, this may seem a little complex. All the more reason to make it boilerplate and get it right at the beginning.

mkfifo(2) vs. mkfifo(1)

Now we're left with the meat (not the most fashionable way to refer to the juicy parts of our code in a vegetarian town like Boulder, Colorado, but we've given up being fashionable).

The easy part of the program is creating the fifo itself: Line 51 calls the POSIX.1 interface, `mkfifo()`, made available by line 4. The second argument to `mkfifo()` specifies the permissions, in octal, with which the fifo should be created. Line 43 translates calls like `mkfifo -m 0777 FOO` directly into the underlying `mkfifo('FOO', 0777)`.

What, though, is line 49 about? Unlike `mkfifo(2)`, which requires that permissions be integers, POSIX.2's `mkfifo` permits symbolic permissions, just like `chmod(1)`. For example, `mkfifo -m g+r FOO` translates as "create a fifo named `FOO`, with the default permissions, but add write permissions for the group." This means we have to figure out how to parse the argument to the `-m` flag.

Symbolic Permissions

One of us, Haemer, spent a little time creating ever-more-complex, incorrect parsing code that worked for most cases and failed at ever-more-obscure edges. Feeling dumber and dumber, he finally realized he was attacking the problem in the wrong way, and turned to a methodology that he has successfully used in the past to conquer difficult programming problems. First, he went to the grocery store and bought a ton of junk food. Next, he brought it back to work, started Netscape to pass the time, and waited.

It was late at night, and the first programmer to rise to the bait was Louis Krupp, who usually starts work around 4 p.m. "How's it going?" asked Louis, coming into Haemer's office and sitting down.

"Fair to partly cloudy. I'm trying to parse symbolic permissions and I can't seem to get it right for anything. I feel like a moron."

"Oh," Louis mumbled, accepting a piece of a candy bar and offering Haemer some potato chips in return. "Like, can you give me an example?"

"I just want to translate things like `g+r` to the right mods to the permissions flags, but every time I get one part right, I break something else."

"Yeah." Louis replied. Eating and thinking a little while longer, he added, "Right." After a few more minutes of silent grazing, Louis went to the whiteboard and wrote down the scheme shown in the `sym_perms()` subroutine on lines 12 through 38.

"Maybe something like that?" said Louis.

Haemer turned it into code, tested it and showed the result to Louis, who had now finished eating most of the potato chips. "Works!"

Louis nodded, smiled, then offered his opinion: "Cool."

In detail: Lines 17 through 28 begin by splitting arguments like `og=rwx` into three parts–"who" (other and group), "how" (set equal to) and "what" (read, write and execute). They then use the information about "who" and "what" to create masks that indicate exactly which parts of the permissions flags should be changed and in what direction. Line 18 provides the special case for "all" (user, group and other).

Lines 29 and 30 are debugging code, left in but commented out, rather than removed. Even when we're completely certain there are no bugs, we remain confident there will be after enough maintenance and enhancement has taken place.

Lines 31 through 37 show how to apply the masks we've built up to give the user what he wants: setting permissions, adding permissions or taking permissions away.

With this step done, so are we.

Cheerleading

As we said at the beginning, we've donated this code to the Perl Power Tools project, although for reasons we explained last month, we think of it as "Software Ptools," the "P" being psilent.

We like the idea of a complete, freely available, UNIX tool set in Perl. So, it appears, do many other folks. Why? We're not sure, but part of it is just the fun of doing it. Getting there really is half the fun. Take a small vacation for an evening and join us. Go to `http://language.perl.com/ppt`, take a look at what's done and what's not, and chip in. Please.

Until next time, happy trails. ➸

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Note: The software from this and past Work columns is available at `http://alumni.caltech.edu/~copeland/work` or alternately at `ftp://ftp.expert.com/pub/Work`.

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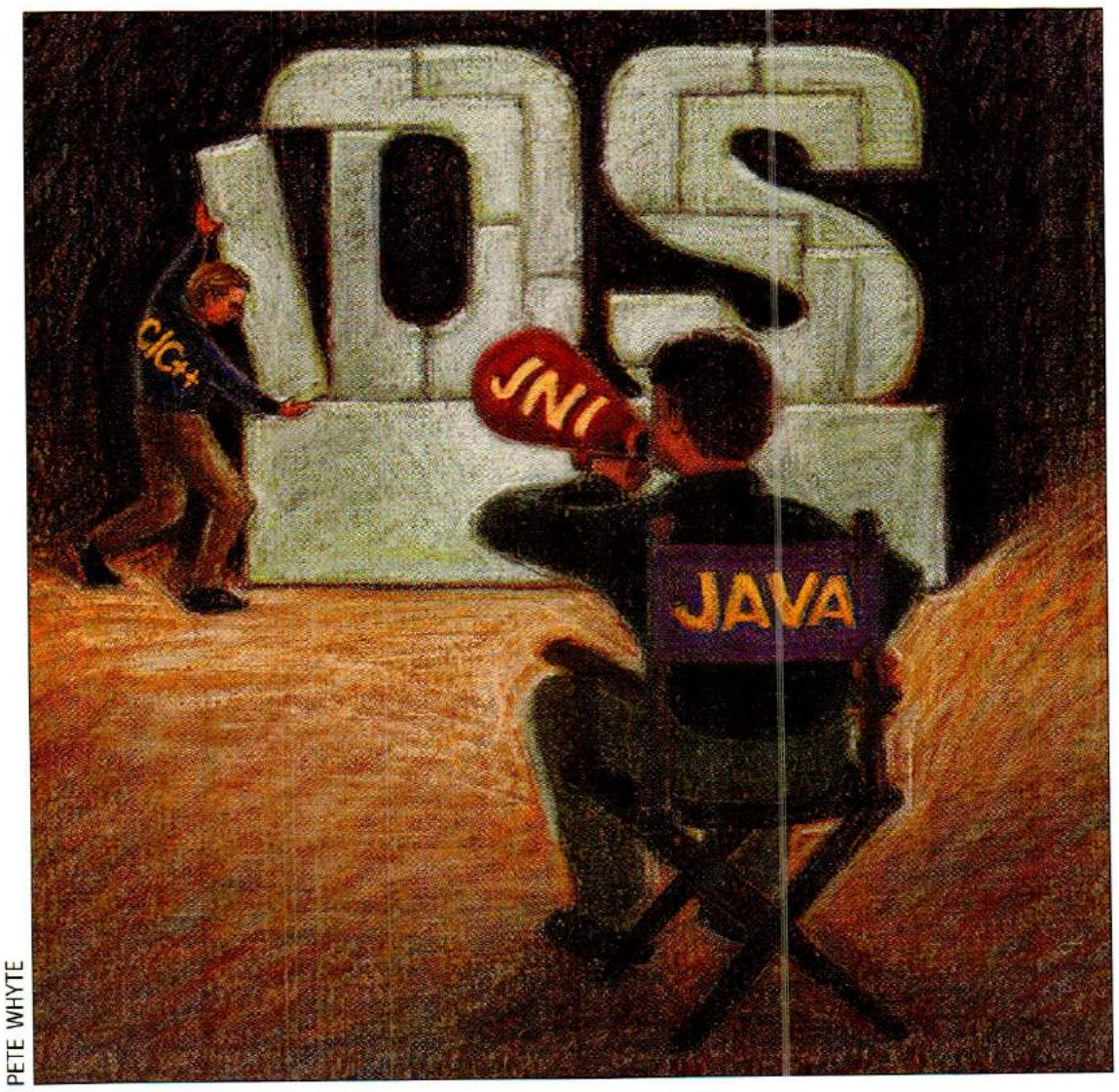
Java Class

by Jim Frost



PETE WHYTE

Going Native

One of the problems with so-called "system independent" programming languages is they have little choice but to limit their functionality to a subset that is available across all of the supported systems. This is often called the least common denominator effect, and it makes it difficult to create applications that are well integrated into the target system.

Least common denominator effects are seen all over the place in Java applications. Many typical GUI features used by applications on Microsoft Corp. Windows are either not supported or supported poorly; applications must interact with the file system in simplistic ways (that is, they don't understand file ownership or file types other than "file" or "directory") and there is no concept of user identity on systems such as UNIX where there are multiple users. These limitations make it very difficult to implement certain applications in Java.

Luckily, Java provides an escape hatch, the Java Native Interface (JNI), which can be used to call back and forth between C/C++ code and Java–opening the door for creating classes that can integrate tightly with the underlying operating system.

This month, we'll demonstrate JNI by writing a Java class that interfaces with the UNIX user ID system to implement the functionality of the `whoami` application. Although we will not survey the full capabilities of JNI, we'll use many of the most common functions to give you the general flavor. The example code may be downloaded from `ftp://ftp.expert.com/pub/JavaClass/09.1999/jni.tar`. Sun Microsystems Inc. provides JNI documentation and a tutorial with the Java Developer Kit (JDK), or you can browse it online at `http://java.sun.com/products/jdk/1.1/docs/guide/jni/index.html`.

The first stage of building a class with JNI methods is to write the Java portion of the class, marking any native methods with the native keyword. Listing 1 shows a Java class describing a UNIX user. It contains three native methods: `whoami()`, `lookupUserByName()` and `lookupUserByUid()`.

The `whoami()` method, which is a class (versus instance) method, determines the user ID of the current user and returns a `UserInfo` object describing that user.

The `lookupUserByName()` and `lookupUserByUid()` methods are instance methods used by the object constructors to populate the object with information. It is their job to look up user information in the password database and fill in the object's data fields.

As with abstract methods, native methods are declared without method bodies. C/C++ code will provide the implementation of the method.

Because Java loads classes on demand rather than linking them together in advance, all C/C++ code used in a Java application must reside in a shared library (a dynamic link library, or `.dll`, on Windows, or a `.so` on UNIX). A shared library containing the necessary native

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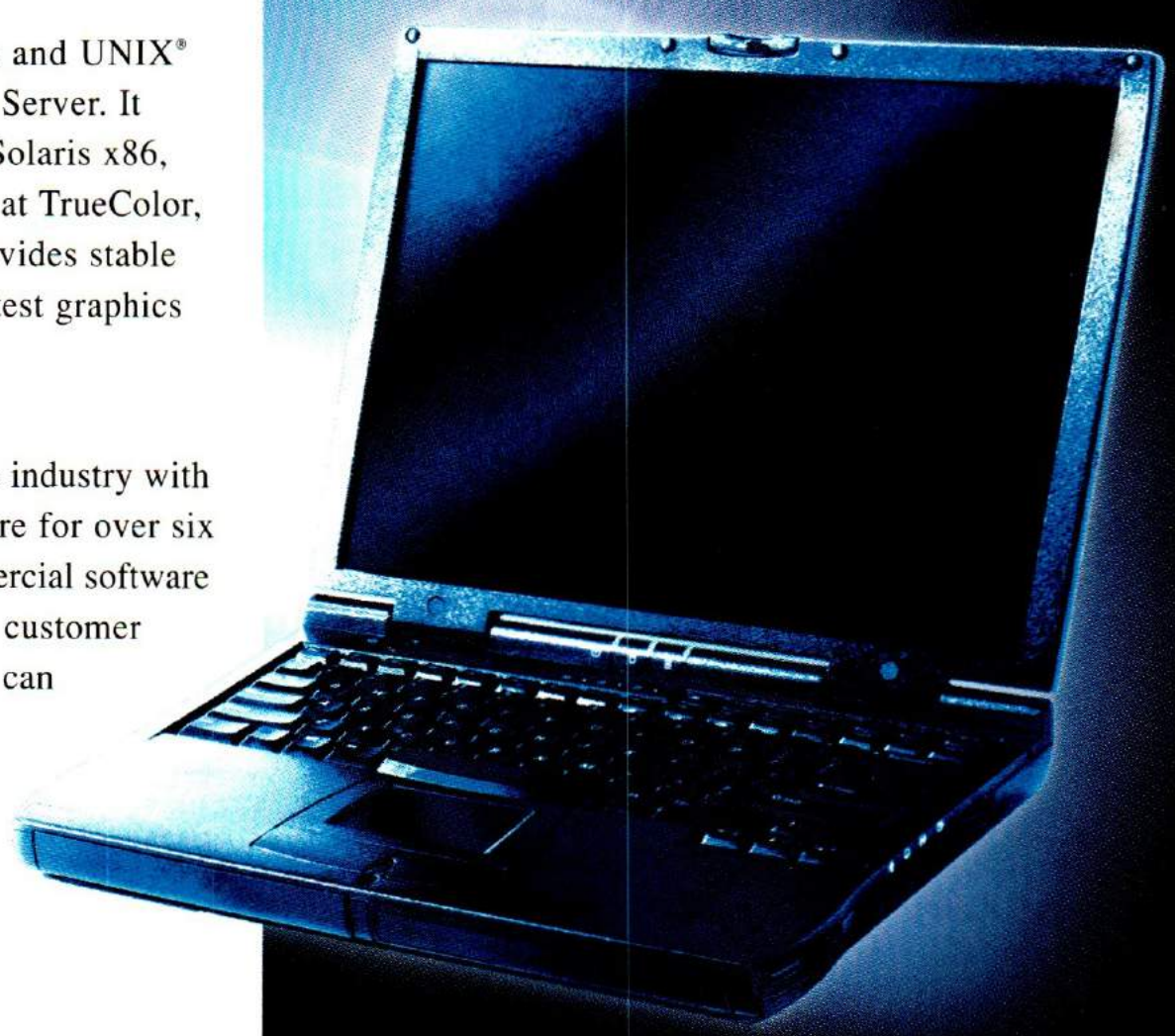

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by Jeffreys Copeland and Haemer

ALEX GROSS

"Put this in your pipe and smoke it."
– Us to each other

"Say please."
– Us to our children

A Pipe Ptool

In the beginning, operating systems provided one method of interprocess communication (IPC): the file. Process A could pass information to process B by writing to a file and letting process B read that file. Even today, when operating systems routinely provide signals, sockets, pipes, fifos, semaphores, message passing and shared memory, this method still works fine.

It is, however, a little slow. Modern operating systems are good about providing file system caches that soften some of the performance penalties, but if process B needs to look through the voluminous output of process A for example, it can be expensive to have process A write all the data to disk and then have process B read it back.

In 1972, Ken Thompson "released" UNIX v2, which provided a new IPC mechanism: pipes. Combined with `fork()` and `exec()`, `pipe()` permitted a pair of related processes to share information without requiring that the information be written to disk. Pipes permitted and promoted the UNIX toolbox philosophy, in which small specialized tools are hooked together to perform single, collaborative jobs.

By UNIX v5, when the first important shell (the Mashey shell) was introduced, pipes were such an important part of UNIX that they merited their own command-line syntax (`'^'`).

Close reading of the paragraphs above, however, reveals a fundamental limitation of pipes: only related processes can communicate over a pipe. In theory, this is not much of a limitation: all UNIX processes on a single processor can trace back to a common ancestor. In practice, though, processes need to be relatively closely related (usually parent and child) to share a pipe. All humans are related if you go back far enough, too. For unrelated processes, the only available IPC mechanism for anything that required passing a lot of information remained the file.

In an early attempt to get around this limitation, Programmer's Workbench UNIX, or PWB UNIX, introduced the "named pipe" or "fifo" (first-in, first-out). To the file system, a fifo looks as though it's a file with a name. You can open it, close it, write to it, read from it and see it in directory listings. It does not, however, correspond to anything on the disk, and it has the semantics of a pipe. Once data are read from it, they're gone. If a program writes into a fifo and it fills up, the writer blocks. If a program reads from it and the fifo is empty, the reader blocks. Data that go through a fifo never leave the buffer cache.

(Every once in a while, this bites us on NFS-networked systems. A fifo created on one machine will appear in the directory of other machines that have that file system mounted, but its data structures are only in the kernel of the host machine. Remembering this when we're trying to use the fifo from another machine and trying to figure out what's wrong always seems to take us forever.)

methods must be loaded before calling any native methods in a Java class. This operation is performed by the static code body in the `UserInfo` class, which performs a `System.loadLibrary()` call. This call performs a dynamic library load as appropriate for the system and type of Java Virtual Machine (JVM). On UNIX, it will load `lib`*`libraryname`*`.so` in a normal JVM or `lib`*`libraryname`*`_g.so` in a debugging JVM (`java_g`). If this call fails, the Java class will not be able to load because the native methods required by the class will not be available.

Things Get Ugly

On the Java side of things, JNI is very easy to use. Simply declare your native methods and load the dynamic library that implements them. Unfortunately, things are much more complicated on the native code side. The first step in writing native code is to run the `javah` utility, provided with the JDK. This utility inspects a compiled Java class for native methods and creates a C/C++ header file describing them. In our example, it is invoked as

```
% javah -jni unix.UserInfo
```

This creates `unix_UserInfo.h` (see Listing 2, Page 41), which contains function signatures for each of the native methods in `unix.UserInfo`. The method signatures are slightly more complicated than their Java counterparts because they must adhere to C's flat namespace and pass information regarding the JVM environment and (if necessary) the object that is to be manipulated by native code. JNI handles C's namespace limitations by naming the method *`packagename_classname_methodname`*`()` (for example, `unix_UserInfo_lookupByUid()`). It's bulky, but clear.

The `JNIEnv` argument, which is passed to every JNI

Listing 1. The UserInfo Class

```
public class UserInfo
{
  private String loginName;
  private int uid;
  private String name;
  private String home;
  private String shell;

  static {
     // load the shared library containing our native code
     System.loadLibrary("unix");
  }

  /** Returns a user information object for the current user. */
  public static native UserInfo whoami();

  /** Looks up a user information according to the user name. */
  public UserInfo(String loginName)
      throws NoSuchUserException
  {
      if (!lookupByLoginName(loginName))
          throw new NoSuchUserException(loginName);
  }

  /** Looks up a user information according to the user's UID. */
  public UserInfo(int uid)
      throws NoSuchUserException
  {
      if (!lookupByUid(uid))
          throw new NoSuchUserException(uid);
  }

  /** Returns the home directory of the user. */
  public String getHome() { return home; }

  /** Returns the login name of the user. */
  public String getLoginName() { return loginName; }

  /** Returns the real name of the user. */
  public String getName() { return name; }
```

Continued on Page 40

Java Class

```
/** Returns the home directory of the user. */
public String getHomeDirectory() { return home; }

/** Returns the shell used by the user. */
public String getShell() { return shell; }

/** Returns the user ID number for the user. */
public int getUid() { return uid; }

/** Native method that performs a getpwnam() call to fill in user information.
 * This is synchronized because getpwnam() is not thread-safe. */
private synchronized native boolean lookupByLoginName(String name);

/** Native method call that performs a getpwuid() call to fill in user information.
 * This is synchronized because getpwuid() is not thread-safe. */
private synchronized native boolean lookupByUid(int uid);

/** Test harness */
public static void main(String[] args)
{
    UserInfo info = whoami();
    if (info == null)
        System.err.println("I have no idea who you are.");
    else {
        System.out.println("You are " + info.getLoginName() + " (" + info.getUid() + ")");
        System.out.println("Your home directory is " + info.getHome());
        System.out.println("Your shell is " + info.getShell());
    }
  }
}
```

method, provides the interface through which C code can talk to the JVM to perform various tasks. Among other things, it provides the ability to create new objects, to manipulate strings and to look up information needed for calling Java methods and setting Java class fields. We'll be using it extensively to do our job.

If the native method is not static, the `JNIEnv` argument will be followed by a `jobject` argument, a reference to the object instance whose method is being called. This is used to call Java instance methods, as well as to manipulate object fields.

The easiest way to create the native code is to copy the method signatures from the generated header file into your C source file and fill them out. This is what was done to create `UserInfo.c` (see Listing 3, Page 42).

Implementing native methods is simple in concept, but somewhat balky in practice (particularly in C). The `JNIEnv` variable supplied with your application is actually a pointer to a pointer to a structure, so it must always be dereferenced before use. I'm sure Sun had good reason for this indirection, but I couldn't even begin to guess what it is–mostly, it just makes the code harder to read and write, and a little slower as well.

Anytime you want to access a Java object member variable or method, you must first find a handle for it. In our example, the `populateObject()` function (used by both the `unix_UserInfo_lookupByName()` and `unix_UserInfo_lookupByUid()` functions) finds the handles for each member variable in the `UserInfo` object.

Notice the fourth argument in the `GetFieldID()` call, this is the type of the member variable you are looking for according to Java's internal type description language. Java's primitive types each have an associated capital letter (see Table 1). Object types use the letter L, followed by the fully qualified name of the class with package names separated by slashes rather than dots, followed by a semicolon (for example, `Ljava/lang/String;`). This representation is reasonably compact and easy for tools to parse, but is somewhat painful for humans to use.

Once you have a handle for the member, you can use the

Table 1. Java Type Representations

Java Type	Representation
`void`	`V`
`boolean`	`Z`
`byte`	`B`
`short`	`S`
`int`	`I`
`long`	`J`
`float`	`F`
`double`	`D`
`class`	`L`*`package/class`*`;`
`array`	`[`
`method`	`(`*`arg_types`*`)`*`return_type`*

various `Get`*`Type`*`Field()` and `Set`*`Type`*`Field()` methods as appropriate for the type of field, allowing you full access to the class data. The `populateObject()` method uses them to fill out the `UserInfo` member variables from information in the password record structure.

Unfortunately, Java and C use different string formats, and even different character formats, so it's necessary to convert between them whenever you're passing strings back and forth. JNI provides several methods for doing this, including `NewString()`, `NewStringUTF()`, `GetStringChars()` and `GetStringUTFChars()`. In our example, we use the UTF format (a way of encoding 16-bit Unicode strings as 8-bit character strings) to simplify the code. UTF corresponds closely to the C string format–at least so long as you're only using English characters. While this works well for our example application, it is poor practice. You should use the `GetStringChars()` method instead and convert between Unicode and ASCII characters.

The `GetStringChars()` and `GetStringUTFChars()` functions allocate memory for the converted characters. You must release them using the appropriate `ReleaseString` method when you are done, otherwise your application will leak memory. The `Java_unix_UserInfo_lookupBy LoginName()` function (in Listing 3) provides an example.

Methods and Constructors

At this point, we've seen how to access member variables, but often we'll want to call back into Java methods from native code. This is done in a manner similar to the one used to access member variables. First, you look up the handle to the method you wish to call using `GetMethodID()`. Then, you use one of several method call functions as appropriate for the type of method and the format of your arguments. The most commonly used method call functions are `New Object()`, `Call`*`Type`*`Method()` and `CallStatic` *`Type`*`Method()`.

As with object fields, there is a Java type specifier that you must supply when looking up methods. The format is an extension of the basic type format. The arguments to the method are strung together and enclosed within parentheses

Listing 2. The UserInfo.h File

```
/* DO NOT EDIT THIS FILE - it is machine generated */
#include <jni.h>
/* Header for class unix_UserInfo */

#ifndef _Included_unix_UserInfo
#define _Included_unix_UserInfo
#ifdef __cplusplus
extern "C" {
#endif
/*
 * Class:     unix_UserInfo
 * Method:    whoami
 * Signature: ()Lunix/UserInfo;
 */
JNIEXPORT jobject JNICALL Java_unix_UserInfo_whoami
  (JNIEnv *, jclass);

/*
 * Class:     unix_UserInfo
 * Method:    lookupByLoginName
 * Signature: (Ljava/lang/String;)Z
 */
JNIEXPORT jboolean JNICALL Java_unix_UserInfo_lookupByLoginName
  (JNIEnv *, jobject, jstring);

/*
 * Class:     unix_UserInfo
 * Method:    lookupByUid
 * Signature: (I)Z
 */
JNIEXPORT jboolean JNICALL Java_unix_UserInfo_lookupByUid
  (JNIEnv *, jobject, jint);

#ifdef __cplusplus
}
#endif
#endif
```

followed by the return type of the method. For example, the method `void foo(int, java.lang.String)` has the type `(ILjava/lang/String;)V`.

The `NewObject()` function is used to create a new object by calling a constructor. Constructor methods have a special signature: the method name is `<init>` and the return type is always `void`. An example of a `NewObject()` call can be found in the `unix_UserInfo_whoami()` function.

The `Call`*`Type`*`Method()` function is used to call a virtual method that returns the specified type. There is also a nonvirtual version, `CallNonvirtualTypeMethod()`, which is useful for calling private or final methods. Similarly, the `CallStatic`*`Type`*`Method()` function is used to call class static methods. While our example doesn't use any of these, their use is similar to `NewObject()`.

Wrapping Up

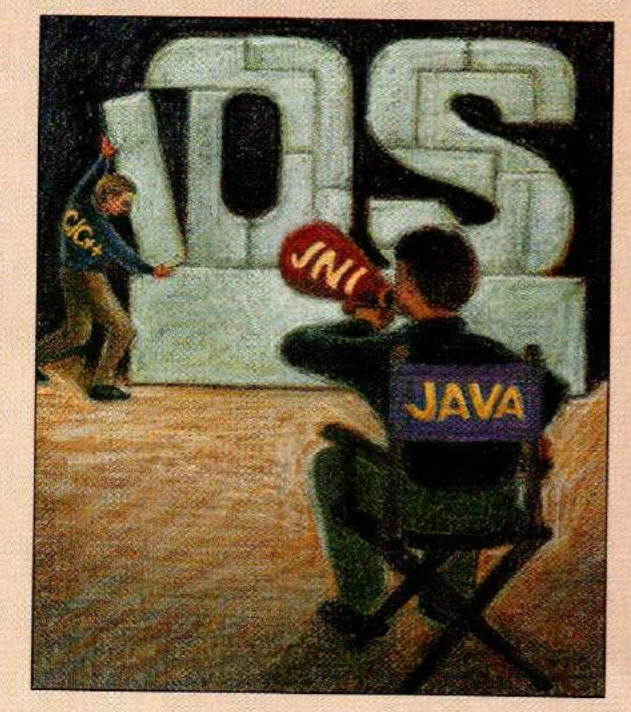
Once you have created your native code, you need to compile it and wrap it up into a shared library. Exactly how this is done depends on your particular system and development environment, so I won't go into detail here. The downloadable form of our example application contains a Makefile that illustrates how this is done under Linux and Solaris. If you're using Windows, the Microsoft Visual C++ environment contains excellent tools and documentation for creating DLLs.

Listing 3. The UserInfo.c File

```
#include <stdio.h> /* for NULL */
#include <pwd.h>
#include "unix_UserInfo.h"

/* Fills in a UserInfo object's fields with information from a UNIX password structure. */
static void populateObject(JNIEnv *jniEnv, jobject objectInstance, struct passwd *pwd)
{
   static jclass clazz;
   static jfieldID loginNameID;
   static jfieldID uidID;
   static jfieldID nameID;
   static jfieldID homeID;
   static jfieldID shellID;
   jstring loginNameString;
   jstring nameString;
   jstring homeString;
   jstring shellString;

   /* Find the object's class */
   clazz = (*jniEnv)->GetObjectClass(jniEnv, objectInstance);

   /* Look up each of the fields we're interested in */
   loginNameID = (*jniEnv)->GetFieldID(jniEnv, clazz, "loginName", "Ljava/lang/String;");
   uidID = (*jniEnv)->GetFieldID(jniEnv, clazz, "uid", "I");
   nameID = (*jniEnv)->GetFieldID(jniEnv, clazz, "name", "Ljava/lang/String;");
   homeID = (*jniEnv)->GetFieldID(jniEnv, clazz, "home", "Ljava/lang/String;");
   shellID = (*jniEnv)->GetFieldID(jniEnv, clazz, "shell", "Ljava/lang/String;");

   /* Convert C strings to Java strings */
   loginNameString = (*jniEnv)->NewStringUTF(jniEnv, pwd->pw_name);
   nameString = (*jniEnv)->NewStringUTF(jniEnv, pwd->pw_gecos);
   homeString = (*jniEnv)->NewStringUTF(jniEnv, pwd->pw_dir);
   shellString = (*jniEnv)->NewStringUTF(jniEnv, pwd->pw_shell);

   /* Set the fields in the UserInfo object */
   (*jniEnv)->SetObjectField(jniEnv, objectInstance, loginNameID, loginNameString);
   (*jniEnv)->SetIntField(jniEnv, objectInstance, uidID, pwd->pw_uid);
   (*jniEnv)->SetObjectField(jniEnv, objectInstance, nameID, nameString);
   (*jniEnv)->SetObjectField(jniEnv, objectInstance, homeID, homeString);
   (*jniEnv)->SetObjectField(jniEnv, objectInstance, shellID, shellString);
}

JNIEXPORT jobject JNICALL Java_unix_UserInfo_whoami
  (JNIEnv *jniEnv, jclass clazz)
{
```

Continued on Page 43

```
static jmethodID constructorID;
jint uid;
jobject userInfo;
jthrowable exception;

/* Look up the constructor method. */
constructorID = (*jniEnv)->GetMethodID(jniEnv, clazz, "<init>", "(I)V");

/* Look up our UID */
uid = getuid();

/* Call the unix.UserInfo(int) constructor */
userInfo = (*jniEnv)->NewObject(jniEnv, clazz, constructorID, uid);

/* See if the constructor threw an exception.  If so, catch it. */
exception = (*jniEnv)->ExceptionOccurred(jniEnv);
if (exception != NULL) { /* handle the exception */
     (*jniEnv)->ExceptionClear(jniEnv);
     return NULL; /* your UID doesn't exist! */
}
return userInfo;
}

JNIEXPORT jboolean JNICALL Java_unix_UserInfo_lookupByLoginName
  (JNIEnv *jniEnv, jobject objectInstance, jstring loginName)
{
   struct passwd *pwd;
   const char* cLoginName;

   cLoginName = (*jniEnv)->GetStringUTFChars(jniEnv, loginName, NULL);
   pwd = getpwnam(cLoginName);
   (*jniEnv)->ReleaseStringUTFChars(jniEnv, loginName, cLoginName);
   if (pwd == NULL)
       return JNI_FALSE;
   else {
       populateObject(jniEnv, objectInstance, pwd);
       return JNI_TRUE;
   }
}

JNIEXPORT jboolean JNICALL Java_unix_UserInfo_lookupByUid
  (JNIEnv *jniEnv, jobject objectInstance, jint uid)
{
   struct passwd *pwd = getpwuid(uid);
   if (pwd == NULL)
       return JNI_FALSE;
   else {
       populateObject(jniEnv, objectInstance, pwd);
       return JNI_TRUE;
   }
}
```



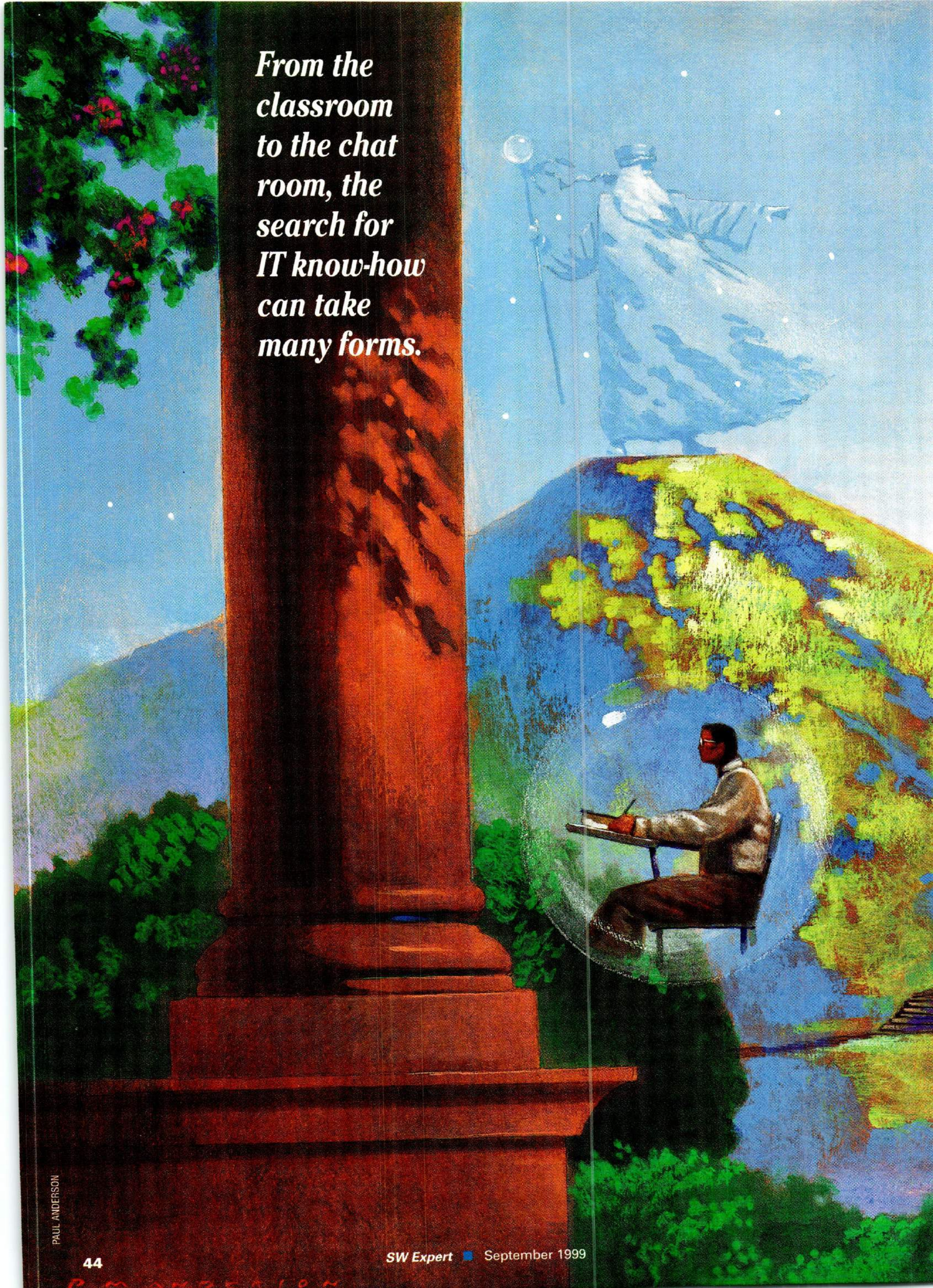
Our example program weaves in and out of native code to perform its job. First, it calls the `whoami()` method, which has the job of finding the user ID. This method then calls back into a Java constructor, and the constructor in turn calls a native method to perform the password database lookup and to populate the object. Voilà! Our application performs some very system-specific tasks that could not be performed with Java alone.

There are a myriad of other features provided by JNI, including the ability to create a JVM within a C/C++ program, and the ability to perform synchronization using an object's monitor. While these are beyond the scope of this column, I encourage you to read the Sun documentation to fill in the blanks.

Next month, we'll take a close look at Java object serialization used heavily by Remote Method Invocation (RMI) and useful for object persistence. ⊷

***Jim Frost** is a software engineer specializing in Java technologies and strong opinions. He may be reached at* `jimf@frostbytes.com`.

From the classroom to the chat room, the search for IT know-how can take many forms.



PAUL ANDERSON

The Age of TECHNICAL Enlightenment

by Patrick T. Coleman, Staff Editor

Over the centuries, many cultures have turned their eyes skyward in search of wisdom. The image of a lone figure ascending an isolated mountain seeking answers is familiar to many of us. Thankfully, finding enlightenment in the digital age doesn't require climbing a steep mountain face in some faraway land, although it does help to turn to a knowledgeable guru.

The options for IT professionals looking to acquire further training are many. They range from sitting in a classroom for an instructor-led session to technology-based training, or TBT, which includes computer-based training (CBT) methods such as CD-ROM–and, even in this digital age, answers can still be found in a good, old book. But, of course, each

training method has its strengths and weaknesses.

Furthermore, not everyone learns the same way. While sitting in a classroom might be the right approach for one person, studying course material from a textbook might be a better alternative for someone else. "For some, the interaction of being in a classroom situation is very important. As for independent learners, they are more inclined toward self-involvement," says Bill Richardson, vice president of educational services at Sun Microsystems Inc., Palo Alto, CA.

When Randy Cook, senior staff consultant with Renaissance Worldwide Inc., a Lincoln, NE-based IT and management consulting firm, wanted to learn Solaris systems administration, he decided the best approach would be to immerse himself in the subject for a couple of months as opposed to one week of intensive training in a classroom.

"I was an NT administrator for a while and wanted to get into the UNIX field," Cook says. "I always felt self-study programs allowed you to learn at your own speed and also gave you the opportunity to have a reference point. You have the opportunity to stop, work with the software, and go back through the test again."

Cook turned to Sun's self-study CDs and he also turned to the UNIX community, posting questions to newsgroups. "The people using UNIX are very eager to teach other people about it," Cook says. "No matter how long you've been working with UNIX, you can still learn something new every day if you try."

But if there is one approach to learning something new that's better than any other, Sun's Richardson says, it's a course that provides a mix of training methods. "What we have found is the best approach is probably a combination," he says.

1998 Survey of IT Training Methods

Delivery Method	*Average % of Courses Taken
Classroom, instructor-led	72.2
Text-only CBT	8.4
CD-ROM	6.8
Multimedia CBT	6.4
Mentoring	5.7
Nonelectronic, self-paced	2.5
Job rotation	2.4
Intranet	2.1
Internet	1.7
Teleconferencing	1.5
Electronic Performance Support Systems (EPSS)	1.2
Interactive TV	1.1
Groupware	0.4

* Some training courses use a mixture of delivery methods.
Source: American Society of Training and Development (ASTD)

If there is one approach to learning something new that's better than any other, it's a course that provides a mix of training methods.

It's an opinion shared by others. "The hybrid classroom actually is the most popular," says Colleen Shutrump, senior analyst for training markets at International Data Corp. (IDC), a Framingham, MA-based research company. "That means a classroom with an instructor, and then within the course itself you can be asked to do something on the computer."

Technical topics such as UNIX systems administration often require a high level of interaction with an instructor and equipment. As such, some analysts feel TBT isn't at the point where it can effectively convey in-depth, technical training material. "A technology-based program would have to be pretty sophisticated in order to deliver UNIX training," says Shutrump. "For highly sophisticated client/server, UNIX and network training, I feel instructor-led [classroom] is the way to go."

Many companies are lining up to offer just that. Polaris Service Inc., Marlborough, MA, is one such company that offers training on hardware and software from Sun and Hewlett-Packard Co. Polaris provides instructor-led courses that emphasize hands-on training with the actual equipment. Learning Tree International, Reston, VA, and Pyramid Design Inc., Hudsonville, MI, both provide instructor-led UNIX- and Windows NT-based training. These courses, which cover topics such as an introduction to UNIX and UNIX server administration for the enterprise, are offered as on-site classes. "The interactive sharing of information between students and the trainer is where we get our highest reviews," says Pyramid's owner Bill Calkins. "We are presenting them with concepts in training. We set up the servers for them and load the applications. That is where the real questions come up and that's where the real need for training is."

Technology in the Classroom

The classroom setting is still the dominant delivery method for IT training. According to a 1998 second-quarter survey conducted by the American Society of Training and Development (ASTD), Alexandria, VA, an association of professionals in the field of workplace learning, more than 72% of all IT courses for that quarter were either entirely or partly instructor-led in a classroom setting. The survey also found that text-based CBT and CD-ROM were the most common methods of TBT (see "1998 Survey of IT Training Methods").

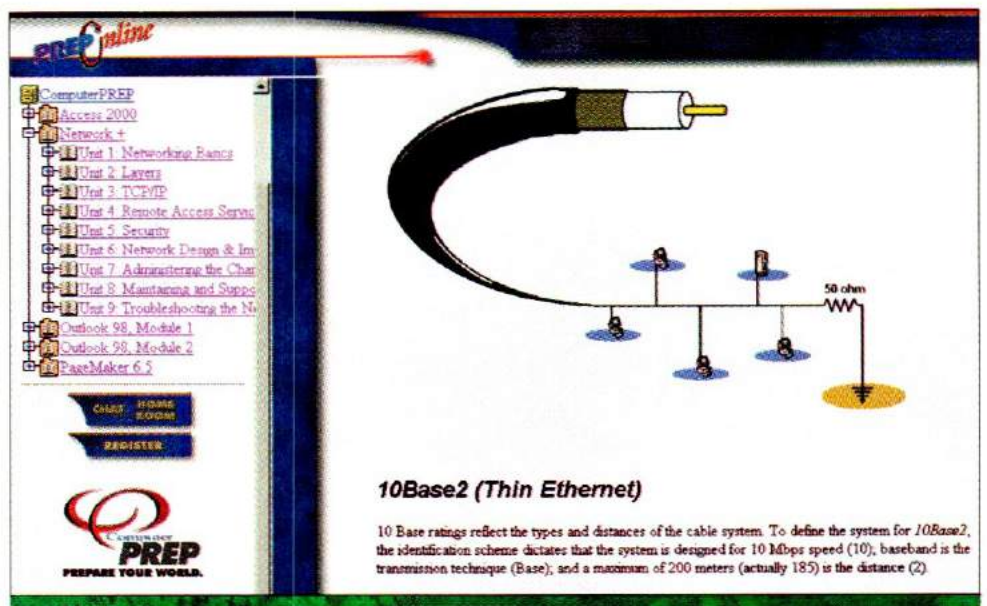
While TBT might not be the most ideal or popular training method today, it could be an entirely different story tomorrow. IDC says traditional instructor-led IT courses currently generate the most revenue in the training market, but they are expected to grow at an annual compounded growth rate of only 3.3% until 2003. TBT, on the other hand, is expected to grow at a rate of 33.2% during the same period. "Traditional instruction-led courses remain the preferred IT training delivery method," says IDC's Shutrump. "But the dominance of this delivery segment is declining."

In its March 1999 report entitled, "Online vs. Onsite: To What Extent Can Live Instruction Be Replaced?," IDC found that CBT–the number one TBT delivery method today–will

take a backseat to Web-based training (WBT) by 2002. "While the Web-based training market is still in the early stages of development, its future looks very strong; but it is unlikely to replace human instruction," says Sheila McGovern, research analyst with IDC. "Next to instructor-led training, WBT is poised to become the largest delivery vehicle for corporate training."

It is this potential growth in WBT that has training companies excited. Peter Bushwell, chief executive officer of ComputerPrep Inc., a Phoenix, AZ-based IT training company, believes the development of online course material will drive the growth of his company. "The online delivery paradigm will more than double the size of my company," he says. But to accomplish this, Web-based courses need to provide users with an experience that offers the same values as the classroom experience. "In the old days, you used something like [Lotus Development Corp. cc:Web], and you could very quickly get your content up on the Web. But it wasn't very effective."

Bushwell's company offers a system called Prep Online, which is a client/server-based system that includes online competency models and adaptive assessment capabilities. With Prep Online, a learner's knowledge is first assessed using a testing feature, then course content is designed to meet the needs of the individual learner. Right now, the Prep Online curriculum covers only application training, although the company does offer instructor-led courses on UNIX fundamentals, systems administration and specific operating systems like AIX, HP-UX and Solaris.


PREP Online
ComputerPREP
Access 2000
Network +
Unit 1: Networking Basics
Unit 2: Layers
Unit 3: TCP/IP
Unit 4: Remote Access Servic
Unit 5: Security
Unit 6: Network Design & Im
Unit 7: Administering the Char
Unit 8: Maintaining and Suppo
Unit 9: Troubleshooting the N
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Outlook 98, Module 2
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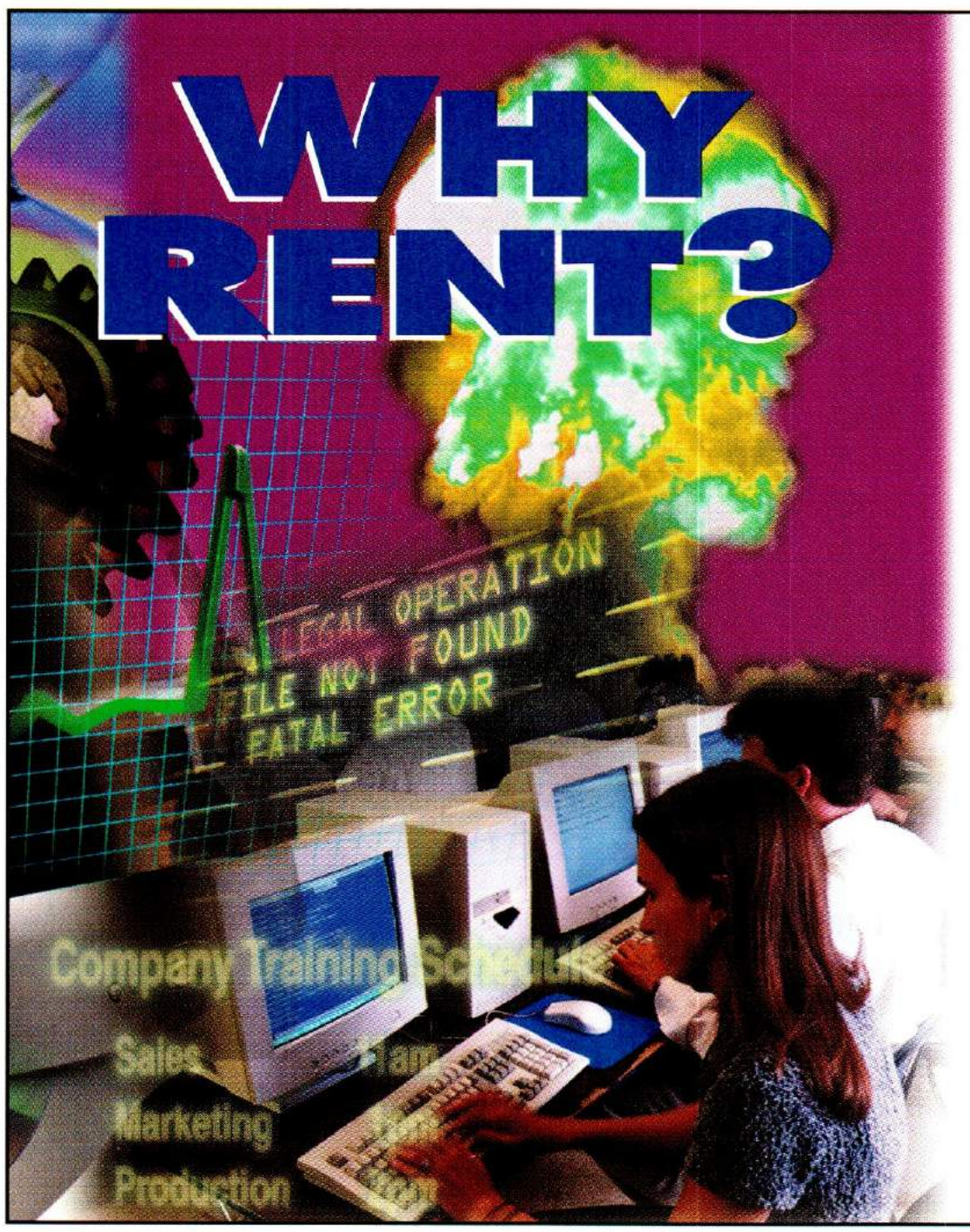
50 ohm
10Base2 (Thin Ethernet)
10 Base ratings reflect the types and distances of the cable system. To define the system for 10Base2, the identification scheme dictates that the system is designed for 10 Mbps speed (10), baseband is the transmission technique (Base), and a maximum of 200 meters (actually 185) is the distance (2).

ComputerPrep's Prep Online WBT system features competency models and adaptive assessment capabilities to ensure course content is designed to meet the needs of the individual.

The success of TBT appears to be tied to a vendor's ability to provide worthwhile content that is also interactive. "From a technology-based standpoint, the more you make the training interactive the better you can mimic real world instructor-based training," says Jim Ayube, senior analyst for TBT at The Aberdeen Group, a Boston MA-based research company. "To make it effective, it has to be interactive."



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Vendor Validation

It's one thing to tell someone you know your stuff. It's another to have proof. To show potential clients or employers that, in fact, they are proficient at certain skills, many IT professionals are turning to vendor certification. The certification, whether it's for Solaris, HP-UX, AIX, IRIX or Windows NT, gives a person technical credibility.

"With certification, it's not just me saying I know something. It's also the vendor," says Randy Cook, senior staff consultant with Renaissance Worldwide Inc., a Lincoln, NE-based IT and management consulting firm. Cook has taken exams to become both a Sun Certified System Administrator and a Microsoft Certified Systems Engineer. "What you have to be able to show is practical experience of working with the product and the certification from the vendor. I think that is an unbeatable combination," Cook says.

Sun offers certifications for the different versions of its UNIX operating systems. To become a Sun Certified System Administrator for Solaris 7, for example, a user must pass a two-part exam with a total of 175 questions. The exam is multiple-choice and asks questions like the following:

When installing a system that is attached to a network, which pieces of information are required for identification? (Select all that apply.)

A) The host name
B) The IP address
C) The domain name
D) The client address

"We started the original Solaris certification program about six years ago," says Bill Richardson, vice president of educational services at Sun Microsystems Inc., Palo Alto, CA. "We're seeing a continuing growth in certification as an enterprise insurance policy to make sure that people running the systems are qualified."

The addition of hardware/software certification on one's résumé can only help the IT professional, and it's for this reason training for this kind of exam has become extremely popular. "Certification has gone through the roof," says Bill Calkins, owner of Pyramid Design Inc., a Hudsonville, MI-based training company. "Whether it's [Windows] NT, [IRIX] or Solaris, we make sure that the courses we put together hit all the objectives of the exams."

Calkins is also the author of a study guide for the Solaris 2.6 exam from Macmillan Technical Publishing entitled, *Solaris 2.6 Administrator Certification Training Guide, Part 1.* "Certification says we know what we're doing," says Calkins. "People are taking the exams to advance their careers."

Because so many IT professionals are now turning to certification as a means to improve their career prospects, vendors, educational companies and publishers are rushing to provide curriculums that will help them prepare for the exams. "The IT professional is very stressed right now," says Colleen Shutrump, senior analyst at International Data Corp, a Framingham, MA-based research company. "Training is becoming more important to both the individual and to companies."

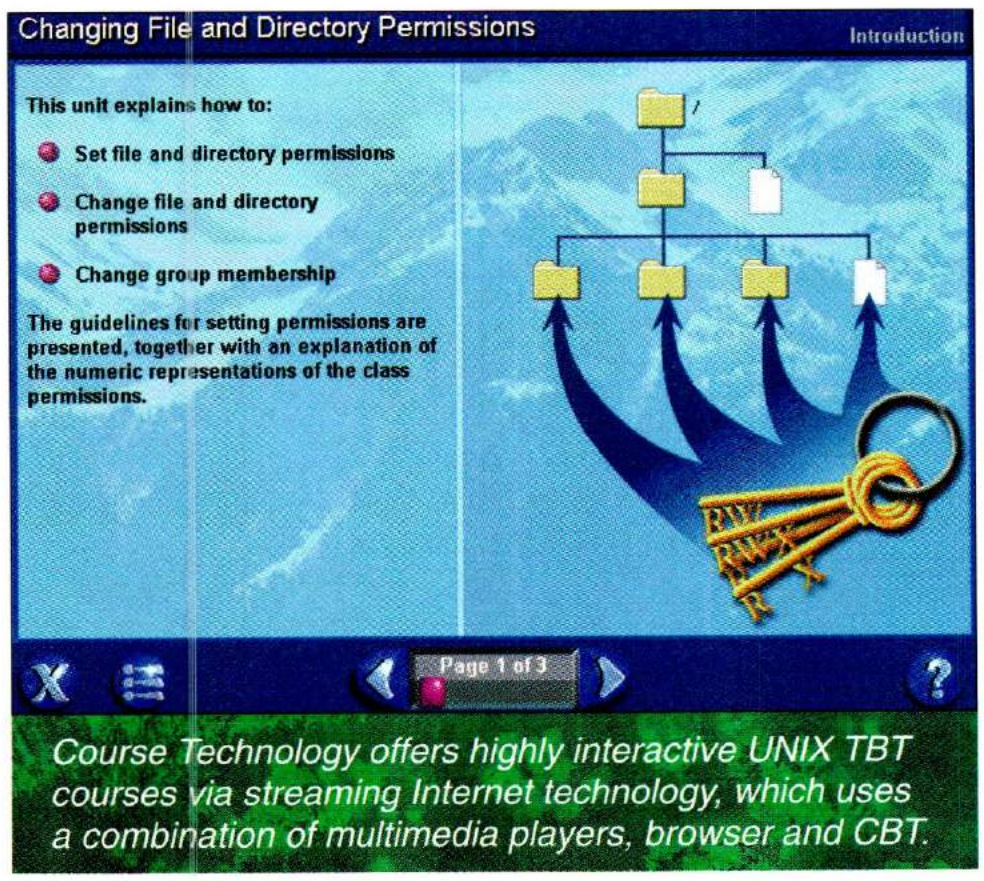
Hopefully, the extra training will mean IT professionals across the board will know that the answer to the sample question above is A and B.–*ptc*

One company leading the charge in developing highly interactive UNIX TBT materials is Course Technology, Cambridge, MA. This longtime publisher of IT training courseware firmly believes in the potential of Web-based training. In fact, Course Technology has undertaken a major redesign of its IT training catalog, currently available in a CBT format, to make courses accessible via corporate intranets or the Internet. "All of our CBT going forward is going to be Web-deliverable," says Mark Reimold, senior product manager at Course Technology.

The company has redesigned its CBT courses to include a high degree of interactivity, self-assessment and simulation. It now offers a CD that installs directly on a local hard drive or runs on a Web server. With the CD installed, users can work their way through the course using a Web browser running Macromedia Inc.'s Shockwave Player and Flash Web Player. The combination of players, browser and CBT means the training content can stream directly to the desktop.

Course topics include an introduction to UNIX, file and directory overview, text editing and formatting, shell programming and systems administration. Course Technology also offers specific courses on HP-UX, Solaris and Linux. "The great advantage of the technology that we chose–the streaming Internet technology–is we don't lose any of the interactivity that you get through CD-ROM-based, multimedia-based CBT even at low-bandwidth Internet connections," says Reimold. "We've got audio, animation and a heavy emphasis on simulation."

Course Technology believes in a strong emphasis on knowledge assessment. All of the company's Web-enabled CBT courses come with preassessment and post-assessment tests,


Changing File and Directory Permissions
Introduction
This unit explains how to:
Set file and directory permissions
Change file and directory permissions
Change group membership
The guidelines for setting permissions are presented, together with an explanation of the numeric representations of the class permissions.
Page 1 of 3
Course Technology offers highly interactive UNIX TBT courses via streaming Internet technology, which uses a combination of multimedia players, browser and CBT.

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SIGNATURE _____ DATE

B Do you now use or plan to use UNIX?

01 ❑ Yes 02 ❑ No

Ca Do you now use or plan to use workstations?

01 ❑ Yes 02 ❑ No

Cb Do you now use or plan to use servers?

01 ❑ Yes 02 ❑ No

D Your company's primary business activity
(Check the **one** best descriptor)

01 ❑ Manufacturing (computer hardware)
02 ❑ Manufacturing (non–computer products)
03 ❑ Systems Integrator, VAR, Sun/SPARC OEM
04 ❑ Software Development
05 ❑ Financial, Banking, Insurance, Real Estate
06 ❑ Retail, Wholesale, Distribution
07 ❑ Utilities, Communication Services, Transportation
08 ❑ Government and/or Military
09 ❑ Health Services, Institutions
10 ❑ Education, Consulting
11 ❑ Agriculture, Mining, Construction, Petroleum
12 ❑ R & D, Testing, Evaluation Labs
14 ❑ Internet Services (ISPs, web design development)
13 ❑ Other (please specify) _____

E Your primary job function
(Check the **one** best descriptor)

01 ❑ Corporate & Financial Management (Pres., Owner, CEO, VP, Marketing Dir., General Manager, Financial VP, CFO, Controller, Treasurer)
03 ❑ IT/IS Management (DP/MIS Dir., Network Dir., Communications Mgr., Systems Analyst, Software Developer, CIO, Systems Administrator)
04 ❑ Engineering Management (VP Engineering, Chief Engr., Technical Director, Systems Integration Mgr.)
05 ❑ Consultants & Educators (Computer/Network Consultant, Computer Technology Educator)
06 ❑ Other (please specify) _____

Ha Which UNIX workstations/servers are you involved with?
(Check **all** that apply)

01 ❑ Sun SPARCstations
02 ❑ Sun SPARCservers
03 ❑ Sun SPARCstation compatibles
04 ❑ Sun SPARCserver compatibles
05 ❑ IBM RS/6000 workstations
06 ❑ IBM RS/6000 servers
07 ❑ Hewlett-Packard workstations
08 ❑ Hewlett-Packard servers
09 ❑ Compaq/DEC workstations
10 ❑ Compaq/DEC servers
11 ❑ Silicon Graphics workstations
12 ❑ Silicon Graphics servers
13 ❑ Other (please specify) _____
14 ❑ None of the above

Name _____
Title _____
Company _____
Address _____
City _____
State ___ Zip Code _____ SSEP9X
Country _____
Telephone No. _____
Fax No. _____
Email _____

❑ Check here if you want to receive new product information and special offers via email.

Hb Which NT workstations/servers are you involved with?
(Check **all** that apply)

A. ❑ Compaq
B. ❑ Dell
C. ❑ Fujitsu
L. ❑ Gateway
D. ❑ Hewlett-Packard
E. ❑ Hitachi
F. ❑ IBM
G. ❑ NEC
H. ❑ Siemens
I. ❑ SGI
J. ❑ Other (please specify _____
K. ❑ None of the above

G For which of the following products, services and/or technologies do you approve, specify, recommend and/or influence the purchase?
(Check **all** that apply)

COMPUTERS
01 ❑ Large-Scale Computers
02 ❑ Midrange Computers
03 ❑ Personal Computers
04 ❑ Portables: Notebooks, Handheld PCs, PDAs
05 ❑ Servers/Workstations
06 ❑ None of the above

PERIPHERALS
07 ❑ Backup Devices
08 ❑ CD-ROM Devices
09 ❑ Color Printers
10 ❑ Front-End Processors
11 ❑ Laser Printers
12 ❑ Modems
13 ❑ Monitors
14 ❑ Multimedia Hardware
15 ❑ RAID
16 ❑ Removable Storage
80 ❑ Storage Area Networks
18 ❑ Storage
19 ❑ Terminals
20 ❑ UPS
21 ❑ None of the above

NETWORKING
22 ❑ ATM
23 ❑ Bridges
24 ❑ CSU/DSU
25 ❑ Email
26 ❑ Frame Relay
27 ❑ Hubs
28 ❑ ISDN
29 ❑ LANs
30 ❑ Multiplexors
31 ❑ Networking/Comm
32 ❑ Software
33 ❑ Network Mgt. Systems
34 ❑ Network Operating Systems
35 ❑ Network Security Services
36 ❑ Network Services
37 ❑ PCMCIA Cards
38 ❑ Routers/Gateways
39 ❑ SMDS
40 ❑ SNA
41 ❑ WANs
42 ❑ X.25
43 ❑ None of the above

SOFTWARE
44 ❑ Appl. Dev/CASE Tools
45 ❑ Client/Server Software
46 ❑ Database Mgt.
47 ❑ Document Mgt. Imaging
48 ❑ Fax Software
49 ❑ Finance/HR Software
81 ❑ Java Tools
51 ❑ Manufacturing Software
52 ❑ OS/Environments
53 ❑ PC Applications
54 ❑ Programming 4GL Languages
55 ❑ Systems Mgt. Software
56 ❑ Utilities
57 ❑ None of the above

SERVERS
58 ❑ Application Servers
59 ❑ Communication Servers
60 ❑ Database Servers
61 ❑ Fax Servers
62 ❑ File Servers
63 ❑ Print Servers
64 ❑ Video Servers
65 ❑ None of the above

INTERNET/INTRANET
66 ❑ Firewall Software
67 ❑ FTP Servers
68 ❑ Internet Service Provider
69 ❑ Browsers
70 ❑ Internet Servers
71 ❑ Intranet Servers
72 ❑ Network Security Software
73 ❑ Remote Access Software
74 ❑ Web Authoring Tools
75 ❑ Web Site Development Tools
76 ❑ None of the above

Continue on other side •••➤

F For what applications are the workstations/servers used at your location?
(Check **all** that apply)

01 ❑ Spreadsheets/Financial Planning
02 ❑ Database Management
03 ❑ Software Development/CASE
04 ❑ CAP/Document Management
05 ❑ Scientific/Engineering/Research
06 ❑ CAD/CAM/CAE
07 ❑ Graphics
09 ❑ Communications Systems
10 ❑ Project Management
14 ❑ Java Development
12 ❑ Other
13 ❑ None of the above

I Number of employees: (Check the **one** best descriptor for both your location and organization)

	At your location	At your entire organization
Under 100	❑ 01	❑ 07
101-500	❑ 02	❑ 08
501-1000	❑ 03	❑ 09
Over 1000	❑ 04	❑ 10
Over 5000	❑ 05	❑ 11
Over 10,000	❑ 06	❑ 12

J Which of the following operating systems/networks, operating systems/environments/protocols are in use/planned for use at this location?
(Check **all** that apply)

OPERATING SYSTEMS

01 ❑ AIX
02 ❑ Compaq/DEC UNIX
04 ❑ HP-UX
05 ❑ IRIX
06 ❑ LINUX
07 ❑ MacOS
08 ❑ MVS
10 ❑ SCO UNIX
11 ❑ Sun/Solaris
14 ❑ Windows
15 ❑ Windows NT
16 ❑ Windows 95
17 ❑ Other (please specify)
_____
_____
18 ❑ None of the above

NETWORK OPERATING SYSTEMS/PROTOCOLS

19 ❑ IPX
20 ❑ LAN Manager (Microsoft)
21 ❑ LAN Server (IBM)
22 ❑ LocalTalk (Apple)
23 ❑ NetWare (Novell)
25 ❑ TCP/IP
27 ❑ Windows NT Advanced Server
28 ❑ Other (please specify)
_____
_____
29 ❑ None of the above

K What is your estimated annual budget for server/workstation products/services?
(Check the **one** best descriptor)

❑ 01 $5 million or more
❑ 02 $1 million – $4.9 million
❑ 03 $500,000 – $1 million
❑ 04 $99,999 – $499,999
❑ 05 Under $99,999

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as well as assessment reports throughout the course. Based on the results of these assessments, topics the participant has already mastered are filtered out, while topics he or she needs to work on are highlighted.

"We treat each unit as independent learning objects, so a customer can assemble their courses on demand," says Course Technology's Reimold.

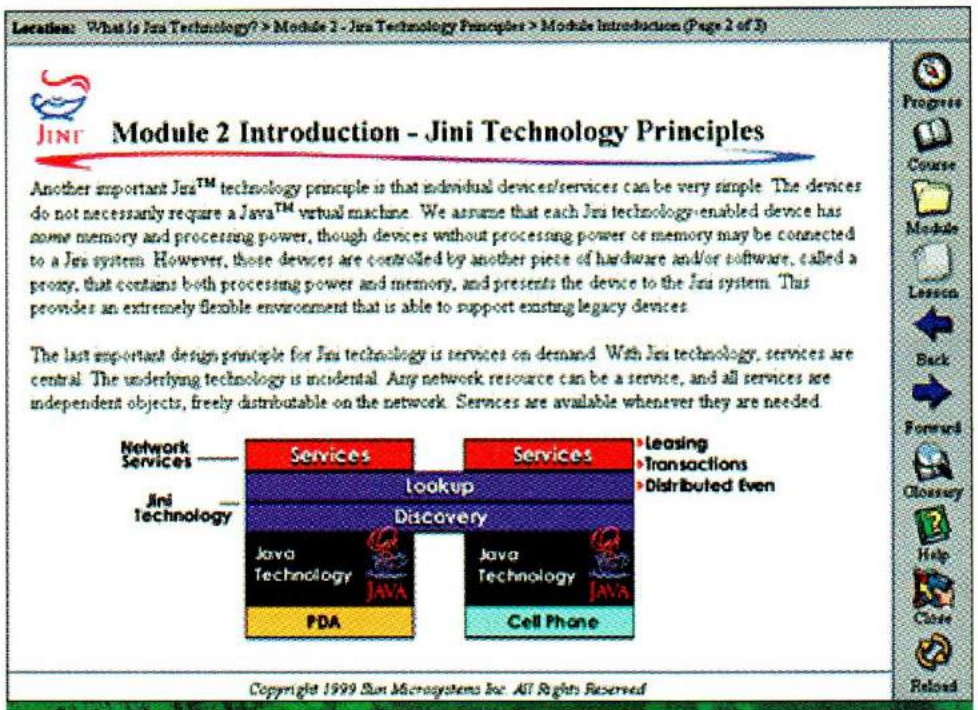
By assessing a learner's skill level at the beginning of the course, valuable time isn't wasted going over previously mastered material. Also, a corporation can evaluate the talent of its IT department by tracking the results of the pretests. Human resources departments could even evaluate potential employees based on their performance using the Course Technology tests.

Other training companies Web-enabling their course materials include Instruction Set Inc., Natick, MA, which currently offers 16 of its classes via the Internet and plans to increase that number to 350 by the end of 1999. Classes include Java programming instruction, an introduction to UNIX and corporate intranets. Instruction Set makes use of the Phoenix software suite from Pathlore Software Corp., Columbus, OH, which uses a client/server architecture to deliver content from a corporate server to the learner's browser.

New Horizons Computer Learning Centers Inc., Santa Ana, CA, is also introducing a new line of Web-based offerings that includes a class to prepare for Solaris certification, in addition to its traditional classroom-based, instructor-led courses.

Vendors Exploit WBT

Even UNIX vendors are getting into the act of Web-enabling their educational services. IBM Corp., Armonk, NY, began a pilot program last year, which included an overview of the RS/6000 SP supercomputer. IBM's Web-based education program attempts to leverage Internet technologies to provide distance learning. With IBM's Web-based approach, the IT expert could be on a mountaintop in Tibet, but as long as there's an Internet connection, the students wouldn't have to leave home, the company says.


Location: What is Jini Technology? > Module 2 - Jini Technology Principles > Module Introduction (Page 2 of 3)
Module 2 Introduction - Jini Technology Principles
Another important Jini™ technology principle is that individual devices/services can be very simple. The devices do not necessarily require a Java™ virtual machine. We assume that each Jini technology-enabled device has some memory and processing power, though devices without processing power or memory may be connected to a Jini system. However, those devices are controlled by another piece of hardware and/or software, called a proxy, that contains both processing power and memory, and presents the device to the Jini system. This provides an extremely flexible environment that is able to support existing legacy devices.
The last important design principle for Jini technology is services on demand. With Jini technology, services are central. The underlying technology is incidental. Any network resource can be a service, and all services are independent objects, freely distributable on the network. Services are available whenever they are needed.
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Jini Technology
Services
Services
Lookup
Discovery
Java Technology
Java Technology
PDA
Cell Phone
Leasing
Transactions
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Progress
Course
Module
Lesson
Back
Forward
Glossary
Help
Close
Reload

Sun jumped onto the WBT bandwagon in August when it began offering a Web-based program on Java programming. Course highlights include getting started with Java, using applets, GUIs and Jini technology.

The IBM Web-based courses are scheduled for specific blocks of time, usually two weeks. Each day, students receive an email message from the instructor. The message includes class notes and a URL directing them to a site to view a presentation, complete with visuals and audio. The email also includes a homework assignment. Completed assignments are then sent to the instructor, along with any questions the participants have, which the instructor attempts to answer before the next presentation.

"That's the approach we have taken, rather than just throw the information out there and see if you can go learn it," says Harvey Seagal, RS/6000 technical education coordinator at IBM. "We are trying to do distance learning to take advantage of the Internet so a person doesn't have to travel anywhere, and also to have some interaction."

The IBM UNIX curriculum includes several courses on RS/6000 systems administration and RS/6000 SP training.

Companies Mentioned in this Article

ComputerPrep Inc.
410 N. 44th St., Ste. 600
Phoenix, AZ 85008
http://www.computerprep.com
Circle 150

Course Technology
1 Main St.
Cambridge, MA 02142
http://www.course.com
Circle 151

IBM Corp.
Contact local sales office
http://www.ibm.com

Instruction Set Inc.
16 Tech Circle
Natick, MA 01760
http://www.instructionset.com
Circle 152

Learning Tree International
1805 Library St.
Reston, VA 20190
http://www.learningtree.com
Circle 153

Macmillan Technical Publishing
201 W. 103rd St.
Indianapolis, IN 46290
http://www.mcp.com
Circle 154

New Horizons Computer Learning Centers Inc.
1231 E. Dyer Road, Ste. 110
Santa Ana, CA 92705
http://www.newhorizons.com
Circle 155

Pathlore Software Corp.
7965 N. High St., Ste. 300
Columbus, OH 43235
http://www.pathlore.com
Circle 156

Polaris Service Inc.
257 Cedar Hill St.
Marlborough, MA 01752
http://www.polarisservice.com
Circle 157

Pyramid Design Inc.
6174 New Holland St.
Hudsonville, MI 49426
http://www.pdesigninc.com
Circle 158

Sun Microsystems Inc.
901 San Antonio Road
Palo Alto, CA 94303
http://www.sun.com
Circle 159

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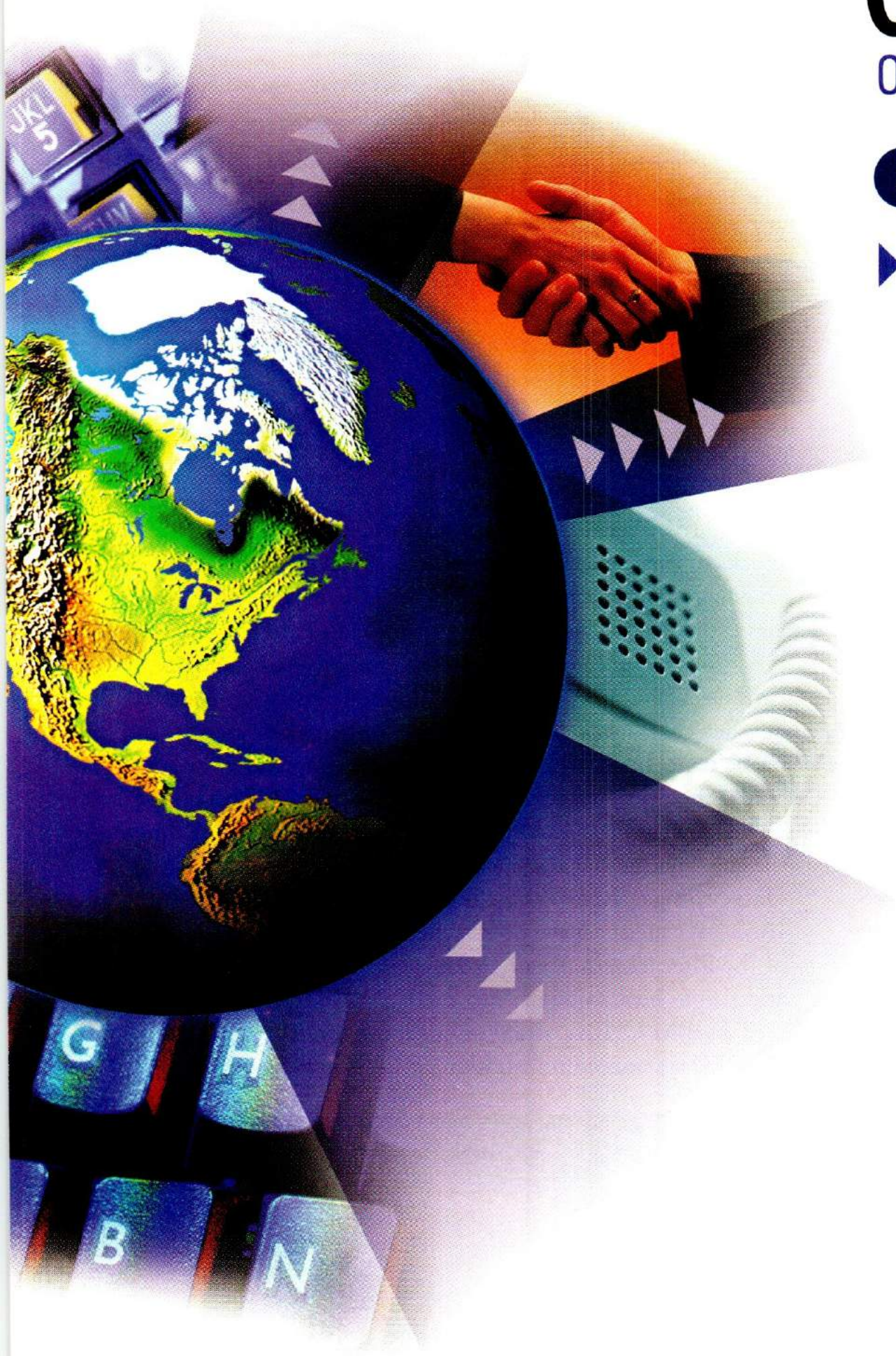

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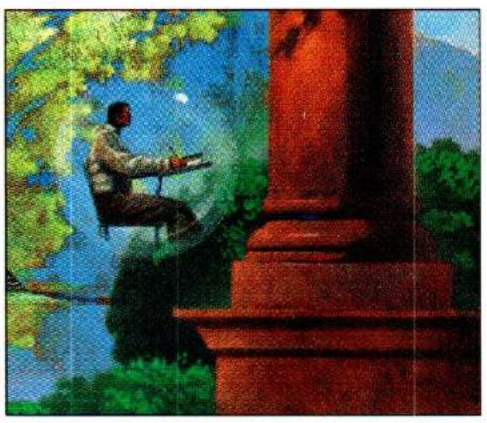
There are also classes on specific applications, such as a recently added course on running Lotus Domino R5 on the RS/6000.

Sun has also jumped into the Web-based education game. In August, the company started a Web-based program on Java programming and Jini technologies. This is just the start of Web-enabled courses from Sun, which plans to introduce a Web-based Solaris program by the end of the year. The courses will focus on getting started with the Java programming language, Jini technology, and using applets, GUIs and the Java Abstract Windowing Toolkit (AWT). Sun's WBT system delivers text, graphics, audio and video.



But if Web-based learning doesn't provide the same experience a classroom does, why are companies turning to it? Besides the predicted growth of this market segment, there are numerous benefits to WBT, and even TBT, over the classroom approach. TBT methods are usually cheaper than traditional training methods. An instructor-led session costs about $1,500 for a week-long course, and requires a commitment of at least two full days. Pyramid Design's on-site training courses, for example, cost $350 per student, per day, but require a minimum of four students to enroll.

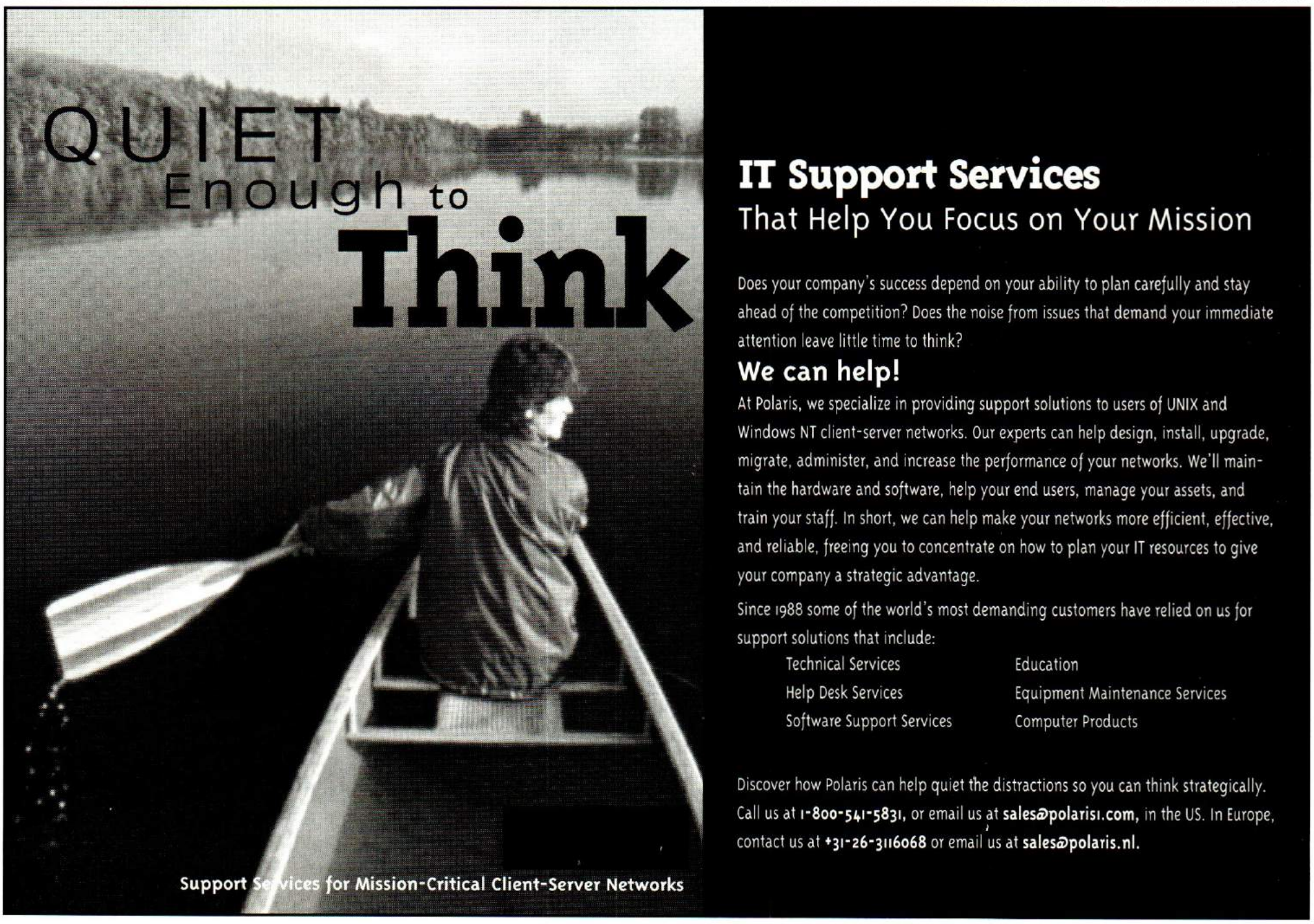
Sun offers five-day Solaris systems administration training courses at a cost of $2,195 per person. In contrast, the courses Sun sells via CD-ROM cost around $1,200 each, and Sun's WBT Java course is priced between $50 and $100 per person.

"But you get a different experience [with a classroom setting]," says Sun's Richardson. "You are paying to have an expert there and you are paying for the hardware, which is available for that experience."

Although the experience isn't as rich as the instructor-led setting, the cost of TBT cetainly makes it an attractive alternative. In addition, TBT–and WBT in particular–emphasizes the advantages of distance learning. Some organizations can't afford to have their IT department off-site for an extended period of time. With TBT, whether it be a CD-ROM or Web-based course, IT staff can learn new material at their own convenience.

Regardless of the benefits WBT offers, this type of training is still fairly new. There are still concerns over bandwidth constraints, and many companies still do not have the capabilities to support TBT. But as Sun's Richardson points out, "We all learn differently." With this being the case, some people will turn to a TBT for enlightenment, while others will still make the trek to see an IT guru.

As technology progresses and TBT evolves to more closely simulate the classroom experience, its popularity will grow. It may not be too long before students turn to their browser to access a virtual classroom, where their classmates will be scattered across the globe and the instructor will conduct the sessions atop a distant mountain.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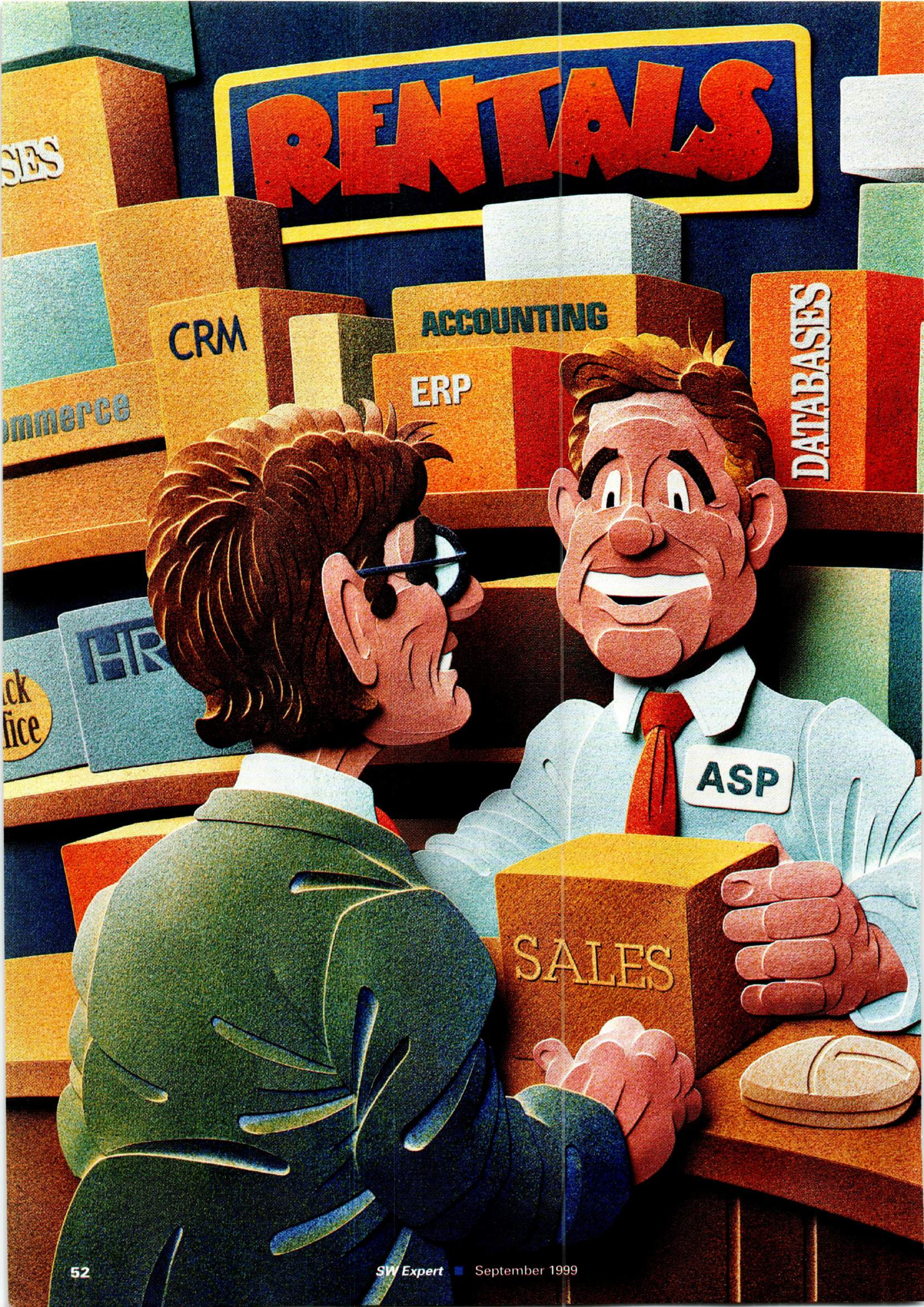
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Application Hosting

BUILD, BUY OR BORROW?

BY SUZANNE HILDRETH, STAFF EDITOR

With everyone from telecommunications companies to software vendors leaping into the application hosting market, it behooves potential customers to watch their step when making the buy versus rent decision.

If your next software project is threatening to overwhelm your staff and devour your budget, you might want to consider a different approach: software rental. It's an alternative that is saving Clarent Corp., a 170-employee Internet telephony company based in Redwood City, CA, a great deal of time and money in implementing its enterprise resource planning (ERP) systems.

"I wouldn't have been able to build up the staff to install, maintain and implement applications of the scale and scope we're doing now [by renting]," says Richard Heaps, chief operating officer at Clarent. In August, Clarent began renting

CHRIS BUTLER

access to PeopleSoft Inc.'s ERP software from Corio Inc., an application service provider (ASP) based in Redwood City, CA. Before choosing to rent, Clarent relied on an accounting package from Intuit Inc. called QuickBooks and a homegrown manufacturing application developed by in-house programmers. "We're a growing organization and our system sophistication needs are also evolving. The systems we had were clearly inadequate," says Heaps, who adds that his staff of five in-house IT employees were actively involved in the decision to rent.

Along with the usual decision of whether to build or buy enterprise software, rental software has emerged as a third option that is piquing the interest of corporate IT managers with minimal capital and less time to spare for implementing new applications. During the past six months, a steady trickle of companies like Clarent have opted to pay a monthly fee to "rent" access to software from online hosting companies.

International Data Corp., a Framingham, MA-based research firm, estimates demand for application rental and hosting services will reach $2 billion by 2003, driven by factors such as increased acceptance of outsourcing, better networking technologies and the increasing ubiquity of electronic commerce, which is forcing businesses of all sizes to implement and maintain sophisticated Web sites.

Small companies don't necessarily need high-level applications, and there are plenty of lower end alternatives on the market that come with modest monthly fees.

Who's opting to "borrow" access to important, enterprise applications? For the moment, mostly small to mid-size companies requiring access to e-commerce or ERP applications they can't afford, or those wishing to upgrade their systems quickly and cheaply. Typically, these companies don't want to rent their entire set of software applications, just one or two specific packages their IT staff lacks the know-how or time to implement and maintain. The high cost of hardware required to run such sophisticated packages is also a factor. A company may opt for a rental solution to avoid having to pony up tens of thousands of dollars for high-end servers and networking equipment.

One such customer is Foodservice.com, an e-commerce start-up based in New York, NY. Earlier this year, the company of seven employees went shopping for the hardware and software needed to launch its online community for foodservice professionals. Because the company's Web site would handle transactions ranging from chat forums and employment listings to online auctions, it couldn't afford to skimp on its systems. Foodservice.com Chief Executive Officer, Karin Wertheim, says that to handle the expected traffic, the company needed to purchase several Sun Microsystems Inc. Enterprise servers, as well as licenses for database software from Oracle Corp. and application server software from Sun and Alaire Corp. But the price tag for the equipment Foodservice.com needed proved dauntingly high. "Between hardware and licensing fees, we would have had to spend almost a half million dollars to do it right," Wertheim says. "We couldn't afford that."

After negotiating with several resellers, Wertheim signed up with Breakaway Solutions Inc., a Boston, MA-based company that provides application hosting and systems integration services. Now Wertheim's company rents access to its application servers and database software running on five shared Enterprise 3500 and 5000 servers located at a New York City data center maintained by Exodus Communications Inc., Santa Clara, CA, a national provider of Internet access and data centers. Breakaway uses Exodus data centers in New York, Santa Clara and San Francisco, and maintains its own data centers in Boston, St. Louis, Washington D.C., Singapore, Tokyo, Melbourne and London.

For the use of its software, hardware and bandwidth, Breakaway charges fees ranging from $5,000 to $25,000 per month, according to Dev Ittycheria, vice president of Breakaway's ASP division. For Wertheim, the monthly fee is a fraction (about 20% to 25%) of what it would've cost to buy the hardware and rent space and Internet access from a colocation facility, and it's more readily scalable. "If our hardware is getting taxed, we can just buy more slivers of each machine–10% or 20% more," Wertheim says. "You only pay for what you need, so as our user base increases, we can turn them up."

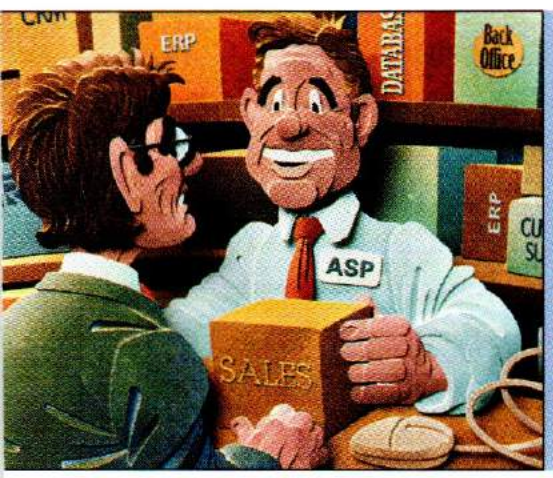
Money Drives Hosting

Money is, in fact, the main reason companies are looking at application hosting. However, not all hosted applications are a bargain. Prices can vary widely, depending on the ASP and the application. For example, Breakaway rents access to Onyx Software Corp.'s Where customer relationship management (CRM) package for $500 per user, per month. But other ASPs may charge as much as $1,000 for access to a more sophisticated ERP package. And that price won't include the up-front implementation fees that high-end ERP packages require. "For enterprise applications, they're still running pretty hefty up-front fees, which, depending on the size of your implementation, can run $150,000 on up to $600,000. So there's still a significant investment involved," says Laurie McCabe, analyst with Summit Strategies, a market research firm based in Boston, MA.

But small companies don't necessarily need high-level applications, and there are plenty of lower end alternatives on the market that come with modest monthly fees and little or no implementation charges. For instance, Employease Inc., Atlanta, GA, offers its online human resources software for just $3 to $4 per employee, per month via its Web-based portal, the Employease Network. Another com-

pany, BizTone.com Inc., San Jose, CA, offers its Java-based financial applications over the Web to any customer willing to pay $.01 per transaction.

Last spring, at a computer industry trade show seminar on buying versus renting applications, Chandra Patel, president and chief executive officer of Isys Solutions, a New York, NY-based IT consulting firm, estimated that most



Hosted software may be served up to the desktop in various ways, including via a simple Web browser interface, a downloadable Java applet or a full-fledged client application that has to be installed.

ASPs are charging between $15 and $85 per seat, per month. But, he noted, higher end applications may be priced at a flat fee of $100,000 to $200,000 per month. "There's not a lot of logic to prices right now," Patel said.

That's mainly because the ASP market is an emerging one and, therefore, still quite unsettled. Many different types of companies, from telecommunications firms to software vendors, have leaped into the ASP market, either offering to rent applications to end users or partnering with other ASPs to provide services or hardware.

Here's a sampling of some recent activity:

• Hewlett-Packard Co., Palo Alto, CA, teamed up in April with SAP America Inc., Newtown Square, PA, and Qwest Communications International Inc., Denver, CO, to offer SAP's R/3 ERP application over Qwest's high-speed network. HP will provide up to $500 million worth of hardware, software and services for the project. At the same time, SAP announced it would outsource its software through EDS Corp., a consulting and systems integration company based in Plano, TX.

• Also in April, Sun unleashed a barrage of products and services targeted at the ASP market under its new ServiceProvider.com initiative. Included in the program are products such as messaging applications and Sun's new I-Planet remote application access software, preconfigured servers and services such as capacity planning and marketing support.

• Cisco Systems Inc., Santa Clara, CA, launched its Hosted Application Initiative–a combination of comarketing efforts, ASP accreditation and a Hosted Applications Development Lab–to work on ways to improve the performance of hosted applications running on Cisco networks. So far, 20 companies have joined the initiative.

• Citrix Systems Inc., Fort Lauderdale, FL, recently formed its own ASP division–the iBusiness Unit–to target the ASP industry with Citrix products and to work on new products for Web server-based applications.

• Microsoft Corp., Redmond, WA, signed a contract in May with Canadian ASP FutureLink Distribution Corp. to pilot the rental licensing of Microsoft's BackOffice products. Providers will pay Microsoft a monthly fee based on the total number of end users who access the system.

• In June, IBM Corp., Armonk, NY, announced application hosting partnerships with SalesLogix Corp., Scottsdale, AZ, Ultimate Software, Weston, FL, and Great Plains Software Inc., Fargo, ND. Depending on the application, customers can either rent-to-own or opt for a straight pay-per-use subscription model. The SalesLogix front-office applications (sales, marketing and customer support) cost $200 per user, per month for three years, with an option to purchase the software at a discount at the end of the lease.

The hosting model could, potentially, have a huge impact on software vendors and how they sell products. According to a recent report from Summit Strategies, "[Application hosting] will alter current software pricing formulas, shift server and software purchase decisions from line-of-business executives to a new class of service providers and create new types of channels to sell these products and services to customers."

Corporate software vendors are sitting up and taking notice of these predictions. Besides SAP, a slew of other ERP vendors, including Oracle, Redwood Shores, CA, PeopleSoft, Pleasanton, CA, Siebel Systems Inc., San Mateo, CA, and Lawson Software, Minneapolis, MN, have announced some type of ASP initiative. ERP vendors in particular have eagerly embraced this new application paradigm because it helps them solve another problem they are facing: a dearth of new customers willing to pay full price for high-end ERP systems. The rental model offers a way to increase market share and revenue by targeting a whole new group of potential customers. "We see it as an opportunity to expand into small to mid-size markets that basically don't have the capital resources to buy an enterprise system, or organizations that don't want to invest heavily in technology infrastructures," says Terry Boevers, public relations manager for Lawson Software.

Building a Better Rental Application

Enterprise software has not traditionally been built to be shared among multiple customers with diverse needs. So software vendors and ASPs must grapple with the problem of how to make highly specialized types of software–such as ERP–fit into this new, mass-market, rental framework.

Currently, hosted software may be served up to the desktop in various ways, including via a simple Web browser interface, a downloadable Java applet, the Citrix Systems ICA protocol (for access to multiuser Windows applications) or a full-fledged client application that has to be installed on each customer desktop.

Summit Strategies' McCabe says applications that have distinct separations between the back-end business logic and the user interface–such as Java

applications constructed on a three- or four-tier model–are much easier to customize for individual clients than those built with a traditional two-tier, client/server architecture, in which the presentation and business logic are combined. "[With a three-tier application] you only have to go in and extend the presentation layer to make it suitable for a particular business. You don't have to recode and mess around with the whole application," McCabe says.

For example, BizTone Chief Executive Officer Darryl Carlton claims that his company's all-Java, thin-client ERP software is constructed to allow customers to tailor the interface to suit the particular workflow style of their business. "They can define the flow of work differently for people in one office versus another. We've found that 85% of customization work has to do with workflow, and that's why we separate [the logic for that] out," Carlton says.

That distinction between the presentation logic and the business logic will allow dNet Corp., a start-up company based in San Francisco, CA, that plans to act as a network between e-commerce providers and local delivery services, to create its own customized version of BizTone for use by its members. "We don't want to handle the back end, we want BizTone to do it. We want to put all of our software resources into the area of dispatching, because that's our specialty," says Greg Kidd, founder of dNet.

ERP applications built in the days of client/server have been particularly slow to transform themselves to the new Web-based, "*n*-tier" model. A few are gradually beginning to rework parts of their applications to support a more distributed, more modular architecture. Most, however, have simply added some sort of browser interface to the existing client/server package. "Some companies just put a screen-scraper over the application to give it a browser front-end. But other providers have really reengineered their application to have it delivered over the Web," says Summit Strategies' McCabe.

The *n*-tier model also offers ASPs some advantages in terms of resource optimization. That's because a distributed, *n*-tier architecture enables an ASP to more easily share applications and servers among multiple customers. Instead of having to dedicate one server per customer, *n*-tier applications allow ASPs to consolidate many customers into a small cluster of servers by putting

Companies Mentioned in this Article

BizTone.com Inc.
111 N. Market St., Ste. 1001
San Jose, CA 95112
http://biztone.com
Circle 160

Breakaway Solutions Inc.
50 Rowes Wharf
Boston, MA 02110
http://www.breakaway.com
Circle 161

Cisco Systems Inc.
170 W. Tasman Drive
San Jose, CA 95134
http://www.cisco.com
Circle 162

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2000 Ultimate Way
Weston, FL 33326
http://www.ultimatesoftware.com
Circle 181

all database processing on one set of servers, all application access on another set of servers and all Web access on yet another. The arrangement also enables an ASP to perform incremental upgrades on parts of the network without shutting off service to customers.

Explains Breakaway's Ittycheria: "When you go to an *n*-tier architecture, you're able to compartmentalize specific functions across the tiers. That allows us to be able to do load balancing, as well as scale our infrastructure, quickly. So I can incrementally add more CPU resources or build up my Web server cluster or my application server cluster, without requiring everyone to go through a forklift upgrade."

But, according to McCabe, "Applications from the client/server model that haven't been engineered for the Web, are not going to give you the same kind of performance."

The ability to share servers among several customers, versus having to equip each customer with their own hardware, is an important capability for ASPs targeting small and mid-size customers. But not all software packages permit such sharing. For example, Microsoft's Exchange messaging and email package does not, although Microsoft has recently announced it will update the next version of Exchange to enable ASPs to create multiple, separate databases and customer accounts on a single server. According to Ittycheria, Windows NT applications have been, in his experience, less flexible than UNIX applications in this regard. "That's why ISPs [Internet service providers] often use some sort of UNIX email application rather than an NT-based email application. We see a lot of NT-based applications that are not as well optimized today for shareability," Ittycheria says.

Eventually, many such technical issues may be worked out via collaborations among software vendors, network providers and ASPs. One such effort that is just getting started is Cisco's Hosted Applications Development Lab, which aims to create specifications for how hosted applications interact with Cisco networks. "For example, one of the things we're doing with all the software providers is making sure the applications are network-aware," says Richard Steranka, director of marketing for Cisco. "We have an initiative today with PeopleSoft, in which, down the road, their software will be able to make calls on our Cisco network operating system to define quality-of-service levels [for different application users]."

Steranka says some of the many standards the Cisco initiative will seek to define include the maximum allowed network latency between the application and the user, the amount of bandwidth required for particular applications or data and the type of traffic prioritization to be used in a hosted-application network.

Another initiative, underway at Sequent Computer Systems Inc., based in Beaverton, OR, and recently acquired by IBM, is the eReady Lab, a so-called "competency center" for software vendors interested in developing rentable versions of their applications. Unveiled in June, the eReady Lab's participants, including software developers and systems integrators, will work on testing the scalability and performance of Web-hosted Windows NT applications. The lab will use Cisco networking equipment and Sequent's NUMACenter platform. Sequent says so far, it has a handful of software vendors working with it on hosted applications.

However, for now, those sorts of testing and standardization initiatives are still in their infancy, and it's likely to take months, even years, before ASPs and their customers see tangible results. Companies trying to evaluate application hosting today need to base their decisions on the speed of the bandwidth for accessing the application, the flexibility and convenience of the user interface, the ASP's timetable for having the application up and running and, of course, the cost.

"The operative question for companies like ours, which absolutely require a systems changeover fairly rapidly, is 'Does application hosting allow you to get to a higher class of system more quickly?'," says Clarent's Heaps, summarizing his assessment of the buy versus build versus borrow decision. "That's the issue that really turned the tide for us."

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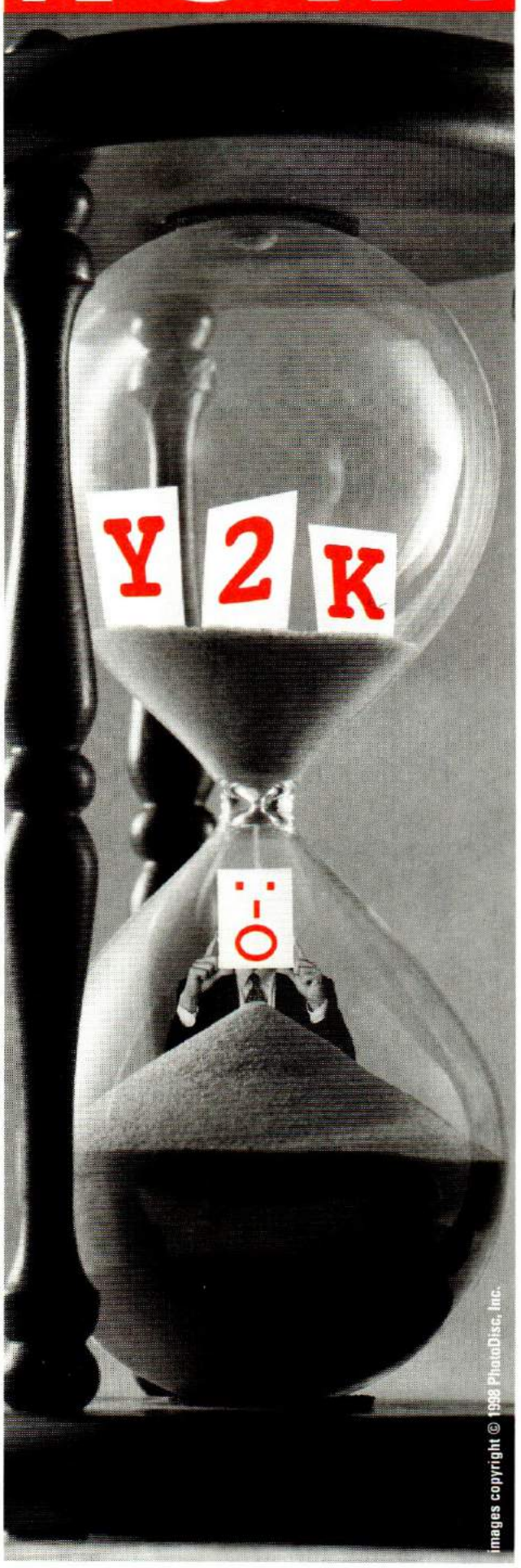

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Circle No. 20

Performance Management for the Enterprise

by **IAN WESTMACOTT, Technical Editor**

If performance is crucial–especially with regard to problem determination and capacity planning–and you're serious about analysis, then TeamQuest Performance Software is well worth a look.

These days, computing is getting complicated. Computers are more complex, applications are more complex and networks are more complex; all in an effort to solve more complex problems. At the same time, our demand for performance increases just as quickly as the complexity of our applications. With so many components affecting performance–storage, processor, communications–it's easy to see why performance analysis itself is a complex problem. Although it's true that performance can be achieved by throwing money at the problem, this strategy can be perilous. Buying a system with twice the processing power (at four times the cost) won't do anything to help an I/O-bound application.

It's even more complicated than that. In most cases, computers run several applications concurrently. As a result, analyzing the resource requirements of a single application in isolation is not enough. The system's contribution to performance as it competes for resources with other applications must be considered, as well as which applications running side by side will make the best use of a given system's resources. More and more, distributed applications and mobile code are becoming critical elements of enterprise computing. The performance of applications can be affected when components execute on disparate systems, each in communication with the others and each competing for resources with other components and applications.

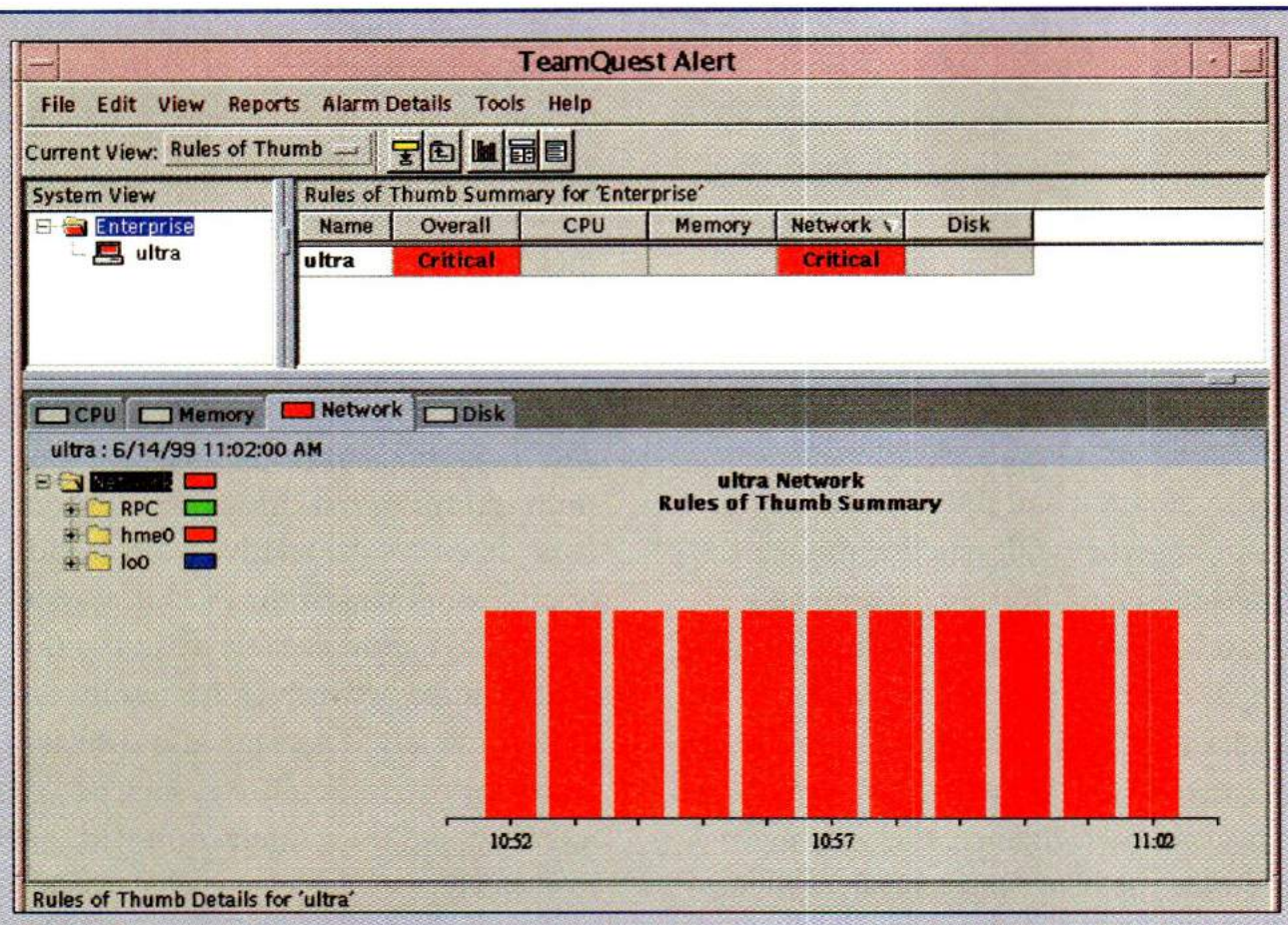
These are problems TeamQuest Corp.'s Performance Software family of products is meant to address. The family provides data collection and analysis of performance metrics in heterogeneous networks, historical and time-aggregate data, predictive modeling, capacity planning and cause and effect correlation. Using the products, you can analyze the performance and resource usage of applications, systems and networks over time, identify resource limitations and performance throttles and investigate what-if scenarios with system configuration. We reviewed TeamQuest Performance Software 7.1, released in November 1998.

The Performance Software family comprises several products. The heart of the system is Performance Framework, which is responsible for monitoring systems and collecting performance data. Framework runs on each system to be monitored. Four companion applications are used to manipulate and analyze the data collected by Performance Framework: TeamQuest Alert, which provides a monitor console for problem investigation; TeamQuest View, which provides a graphical interface for data reporting and analysis; TeamQuest On the Web, which provides a set of Java applets for viewing performance reports with a Web browser; and TeamQuest Model, which is a Microsoft Corp. Windows-based modeling tool for capacity planning and what-if scenarios. All four products are available separately and include Performance Framework.

Performance Framework

The main job of Performance Framework is to collect raw performance data and store it. Framework monitors only the local system, so it must be installed on each system you wish to monitor. Supported platforms include Digital UNIX, HP-UX, AIX, UnixWare, IRIX, Sequent DYNIX/ptx, Solaris SPARC and Windows NT (TeamQuest also offers performance management and planning applications for Unisys Corp. systems). Data measurement and collection is accomplished using a set of "probes," both predefined and user-defined.

Predefined probes include system probes for monitoring CPU, disk, kernel, memory, system calls, tape drives, net-

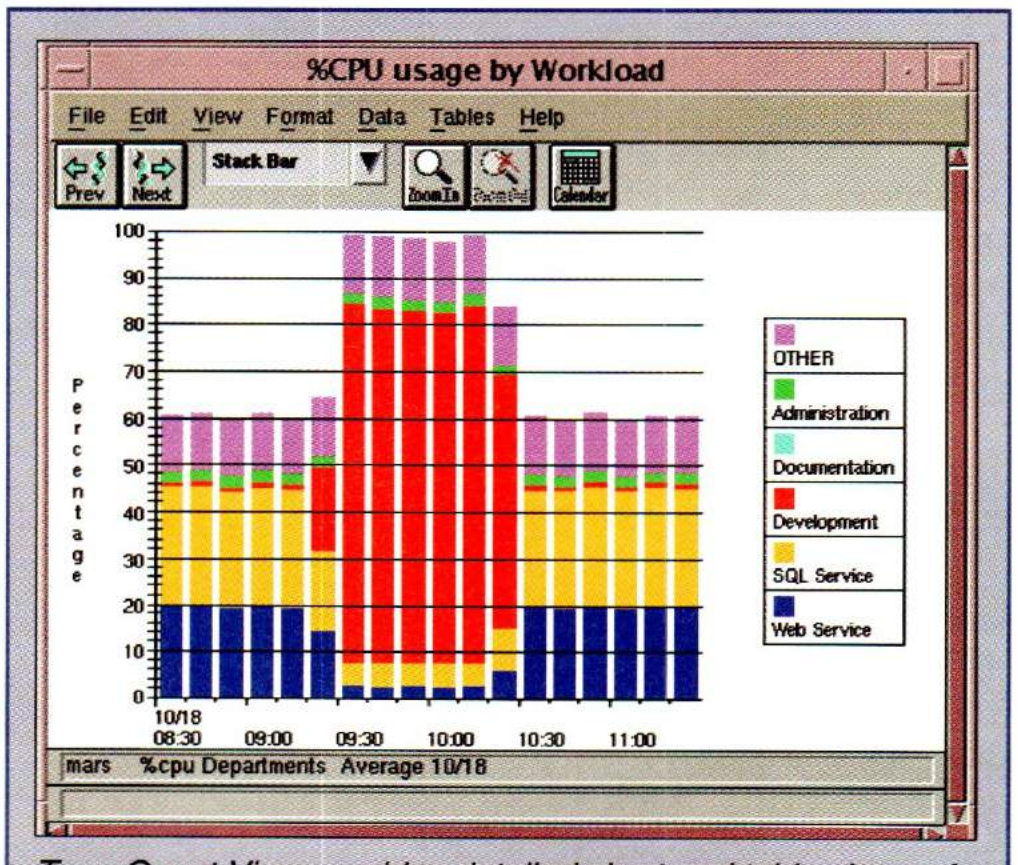


TeamQuest Alert notifies operators when performance thresholds are exceeded. In this case, the number of packet collisions on ultra have exceeded the user-defined threshold.

work interface, local disk space, TCP, NFS and RPC statistics. A workload probe uses process data from kernel memory and process accounting files (which should be turned on) to monitor process usage, and two application probes are provided for monitoring Oracle Corp. and Sybase Inc. database applications. Each of the predefined probes collects statistics on a number of performance metrics. For example, the Oracle probe can collect statistics on more than 80 database metrics. You can customize how much data is actually collected and for what periods of time.

In addition to the predefined probes, two user probes may be used to create simple user-defined probes. Essentially, these are data input ports to the Performance Framework storage system. To use them, you must create an application or shell script that collects the data you are interested in and outputs them in a format acceptable to the user probes. These probes then add the data to the database for use in analysis and modeling. The documentation includes several detailed examples.

While collecting and storing data, the probes can also check data against user-defined thresholds. If any thresholds are exceeded, Performance Framework can generate an alarm (console message, SNMP trap and so on) to notify operators. For example, if you define a system load threshold of "4," then Performance Framework would generate an alarm whenever the load exceeds 4. Performance Framework also includes graphical tools (HP-UX and Solaris SPARC only) for the administration of probes and alarms.



TeamQuest View provides detailed chart and table views of monitored data.

The final job of Performance Framework is to export the collected data. Framework provides secure application interfaces for the companion applications (Alert, View, On the Web and Model), import and export tools to move data between platforms and character-based tools for data/statistics reporting and administration. Another useful feature of Performance Framework is the ability to define workgroups. Workgroups are a method for classifying collected data into groups based on criteria such as groups of users, applications or components. For example, you could define a group of management users, compilers installed in the system or system storage devices. When Performance Framework exports data to the companion applications, they may be used to perform analysis on specific workgroups.

Alert

TeamQuest Alert provides an enterprisewide hierarchical view of monitored systems at-a-glance. Alert may be used to instantly determine whether monitored systems are operating within thresholds, and the drill-down GUI allows you to view any monitored data on any system in real time. Meanwhile, if any thresholds are exceeded, Performance Framework notifies Alert, which in turn flags the component/system/network in the hierarchical view. As a result, operators are immediately alerted to exceptions in system performance. TeamQuest Alert is supported on HP-UX, Solaris SPARC and Windows 95/NT systems.

View

TeamQuest View provides a graphical interface for data reporting and analysis. View offers a number of drill-down graph and table views of monitored data, which allow operators to analyze and identify performance problems. For example, a CPU utilization graph may indicate abnormal CPU usage during a certain period of time. An operator may click on the outlier area of the graph to obtain a table

of all processes running in the system at that time, including their owners, memory use, CPU use and so on. The table data may be manipulated in various ways to determine the processes involved with the abnormal behavior.

Charts may also be generated from table data. For example, you can view a table of logged alarms, which may include a "CPU Busy" alarm. By clicking on this entry, you can produce a chart of the busy activity then drill down to discover the processes involved. TeamQuest View is supported on Digital UNIX, HP-UX, AIX, UnixWare, IRIX, Solaris SPARC and Windows 95/NT systems.

On the Web

TeamQuest On the Web provides a means for accessing Performance Framework data via a Web browser. It comprises static HTML pages, Java applets and CGI scripts. To use On the Web you must have a Web server already installed and running. If a Web server is not running on the machine to be monitored, and you cannot NFS mount a common file system, scripts are provided for FTP or RPC data file transfer. These methods also allow you to monitor multiple systems with a single Web server. TeamQuest On the Web is supported on Digital UNIX, HP-UX, AIX, UnixWare, Sequent DYNIX/ptx, IRIX, Solaris SPARC and Windows 95/NT systems.

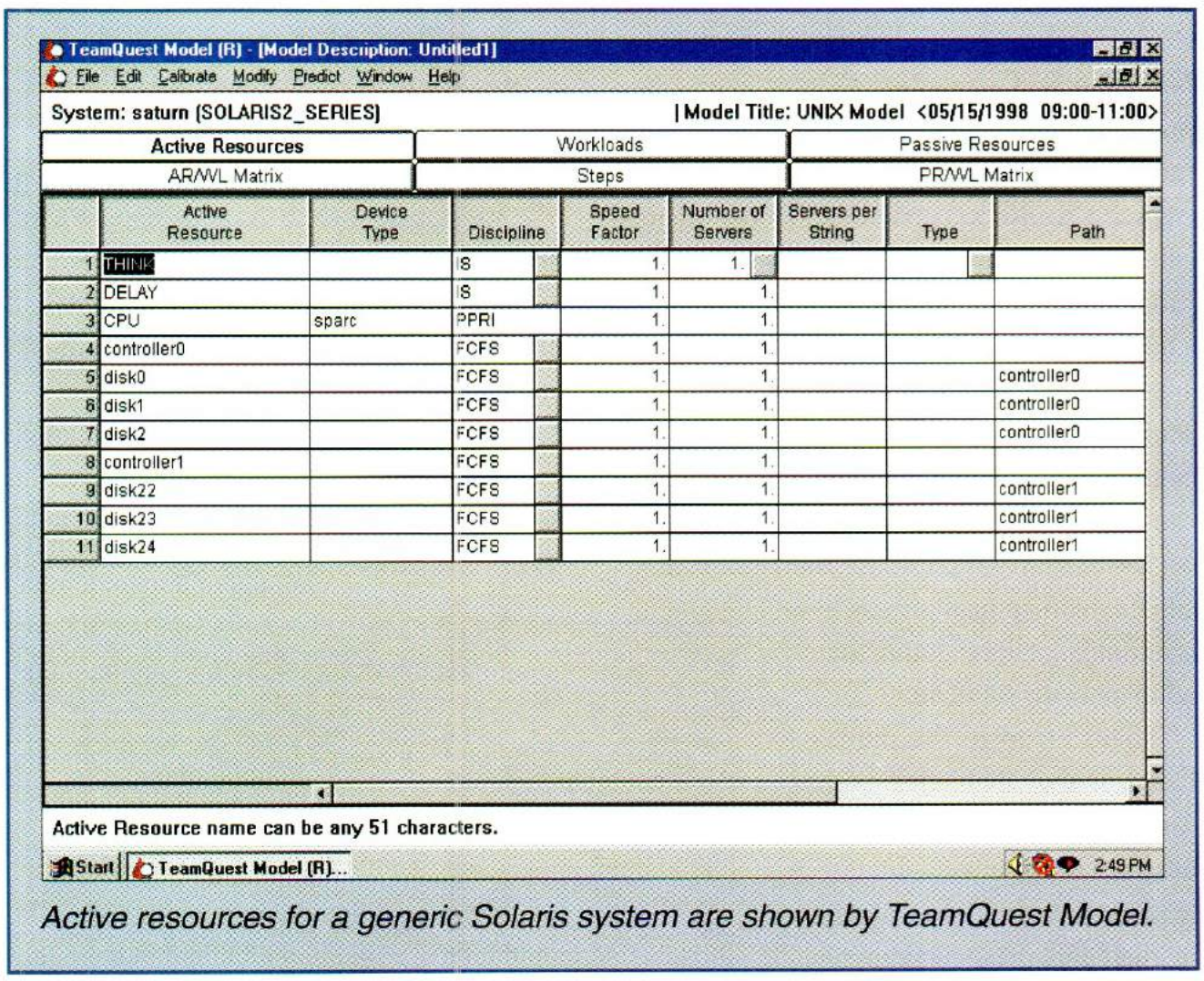
Model

TeamQuest Model is a Windows 95/NT application, which may be used to analyze Performance Framework data for capacity planning and what-if scenarios. Although Model is a Windows application, it may be used to build models for Performance Framework data from UNIX or Unisys systems, or Hewlett-Packard Co. MeasureWare data. This is accomplished by exporting the data from the systems in question and importing them into Model. Although other TeamQuest applications can connect to and obtain data from running Performance Framework processes across the network, Model cannot.

Model uses iterative mean value approximation and discrete event simulation together with baseline models to build representations of existing and hypothetical systems. For example, you might model how a system will behave under projected workload growth and estimate when and what components will constrain performance. Or, you might estimate the benefit of adding new components, such as CPUs or disks, or model whether a given server could handle the migration of a development team.

A system model consists of several tables. An active resources table contains descriptions of all the resources which act as servers in the system. For example, CPUs would be listed here, together with their relative performance and queuing discipline (preemptive priority or first-come, first-served). A workloads table lists the defined workloads of the system and their characteristics, such as response time and measured throughput. Another table describes the relative contribution of each workload to the overall system activity. Yet another table describes the relationships between active resources and workloads. There are also similar tables for passive resources, such as memory, and their interaction with workloads.

When Performance Framework data is imported into Model, a baseline system model is built using measured val-


TeamQuest Model (R) - [Model Description: Untitled1]
File Edit Calibrate Modify Predict Window Help
System: saturn (SOLARIS2_SERIES)
| Model Title: UNIX Model <05/15/1998 09:00-11:00>
Active Resources
Workloads
Passive Resources
AR/WL Matrix
Steps
PR/WL Matrix
Active Resource | Device Type | Discipline | Speed Factor | Number of Servers | Servers per String | Type | Path
1 THINK | | IS | 1. | 1. | | |
2 DELAY | | IS | 1. | 1. | | |
3 CPU | sparc | PPRI | 1. | 1. | | |
4 controller0 | | FCFS | 1. | 1. | | |
5 disk0 | | FCFS | 1. | 1. | | | controller0
6 disk1 | | FCFS | 1. | 1. | | | controller0
7 disk2 | | FCFS | 1. | 1. | | | controller0
8 controller1 | | FCFS | 1. | 1. | | |
9 disk22 | | FCFS | 1. | 1. | | | controller1
10 disk23 | | FCFS | 1. | 1. | | | controller1
11 disk24 | | FCFS | 1. | 1. | | | controller1
Active Resource name can be any 51 characters.
Start
TeamQuest Model (R)...
2:49 PM

Active resources for a generic Solaris system are shown by TeamQuest Model.

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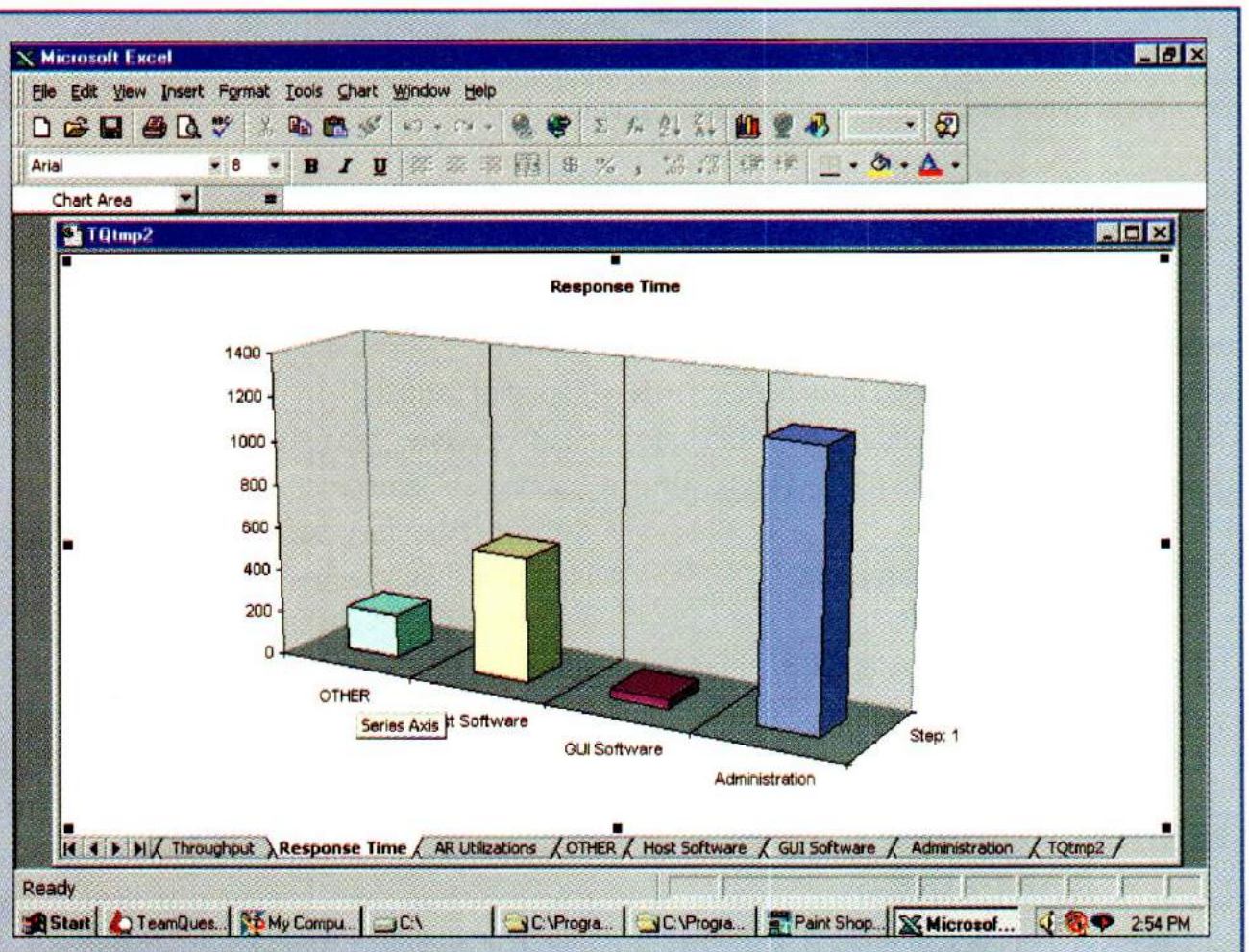

TeamQuest Model makes use of OLE2 to chart solutions using Microsoft Excel.

ues and default relationships. This baseline model must then be calibrated so that performance predicted by the model matches measured performance data. Model can perform this calibration automatically, or the model may be tuned by hand.

Once a model is calibrated, it can be used to chart actual or predicted performance measures, such as throughput, response time and resource usage. Model makes use of Object Linking and Embedding 2 (OLE2) to perform all charting and graphing in Microsoft Excel (sold separately). When a model is solved with either actual or predicted parameters, the solution is exported to an Excel spreadsheet and a number of charts are automatically defined.

Installation of the TeamQuest Performance Software suite is typical, and clearly written installation manuals are included. Performance Framework requires 80 to 100 MB of disk space for UNIX systems and about 50 MB for Windows NT. Alert requires an additional 11 MB (8 MB on NT) and View requires about 15 MB (8 MB on NT). Model requires only 3 MB of space. The hard copy documentation manuals are excellent and comprehensive, and the online hyperlinked documentation is also superb (using Bristol Technology Inc.'s HyperHelp on UNIX systems).

Summary

We were impressed with TeamQuest Performance Software. The suite provides a comprehensive set of tools for enterprisewide system performance analysis and prediction. You need to be serious about performance analysis to consider this product, however. It requires substantial configuration, training and maintenance. But if performance is critical in your operations, particularly with regard to problem determination and capacity planning, TeamQuest is well worth a look.

The only place we found Performance Software lacking is in its system-centric model. While there is support for low-level distributed analysis (in the form of per-system network statistics), there is no real facility for analyzing distributed systems and groups of systems. For example, you might want to analyze the overall performance of a network-attached storage device. With TeamQuest, you can only look at performance on a per-client basis.

We would also like to see more application probes, such as probes for a wider range of databases and probes for common messaging, directory, Web and application server software. Of course, all of this can be done using the user-defined probes, but some more off-the-shelf options would be convenient. Also, language APIs for Performance Framework might encourage end-user and third-party probe development.

The implementation is excellent, from the online help system to the first-rate Motif interface (one of the best we have seen) to the seamless OLE integration of Model and Microsoft Excel. The Windows interface of the various tools isn't as impressive as the Motif implementation, but is nothing to complain about. Overall, the software engineering of TeamQuest Performance Software is very good, and it seems Sun Professional Services agrees. In May, TeamQuest and Sun Microsystems Inc. formed an agreement in which Performance Software would be used in Sun's Server Consolidation Services for performance analysis and capacity planning. ➸

TeamQuest Performance Software

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WWW
http://www.teamquest.com

Best Feature
First-rate implementation

Worst Feature
Too few application probes

Price
Performance Software has a tiered pricing structure. For Tier 2 (midrange servers with five to eight processors) pricing is as follows:

Alert
1st server $8,445
Additional servers $2,530 each

View
1st server $6,495
Additional servers $1,945 each

On the Web
1st server $8,445
Additional servers $2,530 each

Model
1st workstation $19,995
Additional workstations $15,996 each

(volume discounts are available)

Circle 185

NEW PRODUCTS

The product descriptions are compiled from data supplied by the vendors. To contact them for more detailed information, circle the appropriate reader service number on the card located elsewhere in this issue.

New Addition to Data Silo Storage Line

Kingston Technology has announced the latest addition to its Data Silo storage enclosure product line. The DS350 is a four-bay, rack-mount external expansion chassis for Just a Bunch Of Disks (JBOD) applications, which provides four half-height peripheral bays to house either 3.5- or 5.25-inch SCSI devices.

The 5.1- by 19- by 22.5-inch unit is designed for users who want to configure systems using a rack-mount cabinet, but still require a product similar in design and construction to Kingston's DS100 storage enclosure, the company says. The DS350 features four horizontal bays for CD-ROMs to accommodate multimedia users. In addition, it supports SCSI 2, 3, Ultra and Ultra 2 drives, and comes with device activity/fault LED indicators and three high-speed cooling fans. The DS350 costs $550.

Kingston Technology Co.
17600 Newhope St.
Fountain Valley, CA 92708
http://www.kingston.com
Circle 101

Testing Tool Kit for UNIX Applications

OC Systems has released Aprobe, a software tool kit that reportedly allows developers to define their own tools for testing, debugging, performance tuning and requirements verification. With Aprobe, developers can create probes that attach to an application's compiled code, the company says. The probes, which are typically small and nonintrusive, can log information or change the way a program runs. Any resulting data is formatted for easy readability.

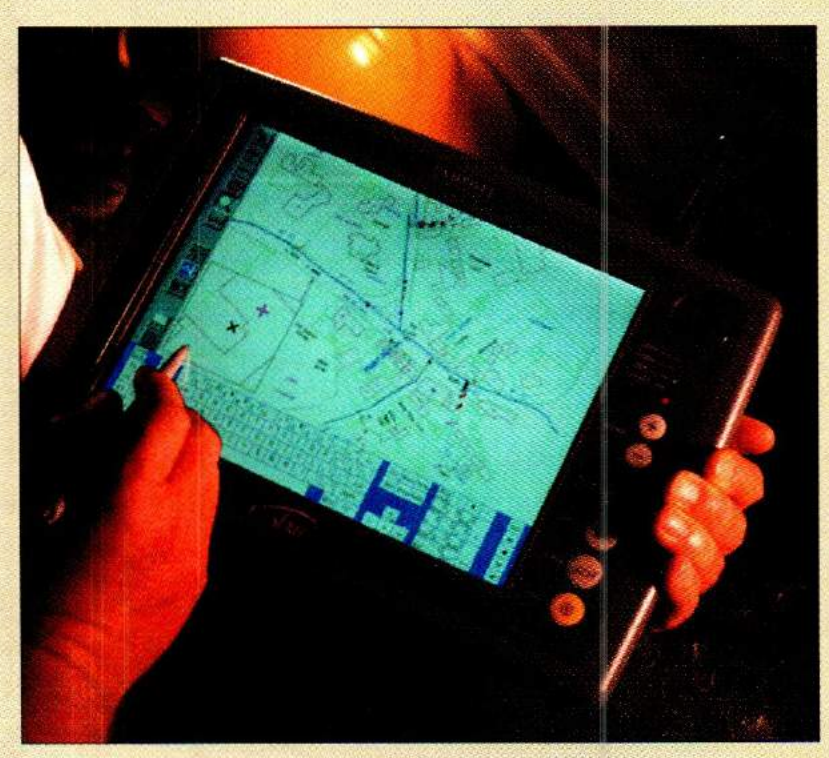
The probes work on the actual executable, so there is no need to create special builds for testing, OC Systems says. Also, Aprobe does not require access to source code, so it can be used on third-party and off-the-shelf software, as well as in-house applications. It supports C, C++ and Ada. The probes are written in C, so developers are not required to learn a custom language to create probes.

Designed to work on large, real-time networked or distributed systems, Aprobe can be used in different phases of the development cycle–for example, debugging, testing and integration, fault injection, performance tuning, requirements verification or software maintenance. The five sample probes included with Aprobe are: Test Coverage, to show which lines of code have or haven't been executed; Heap Tracking, to give a snapshot of heap usage and show any outstanding allocations performed since the previous snapshot; Profiling, which does

Java-Based Field Information System

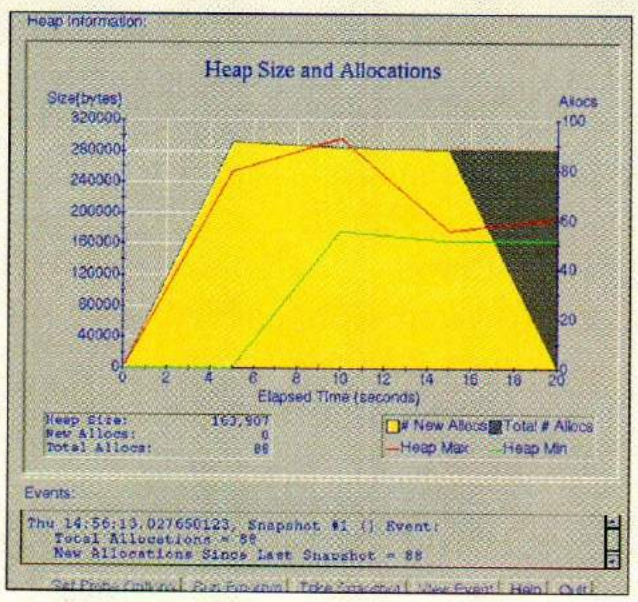
Tadpole has released a Java-based field information system aimed at the utilities, telecommunications and public service industries. The Tadpole-Cartesia system is said to enable organizations to put detailed mapping and job-specific information into the hands of field workers quickly and cost-effectively. In addition, it can track work in progress and maintain an accurate database of field assets.

The heart of the system is its Enterprise Field Server (EFS), which interfaces with existing corporate systems via Java, CORBA and RDBMS connectivity tools to assemble and feed customized job files to field teams. Data can include interactive maps derived from geographic information systems (GIS), network diagrams, asset information and schematics, which can be viewed and manipulated using Cartesia-Redline client software, the company says. Tadpole also provides a complimentary hardware solution, J-Slate–a notepad-size, battery-powered diskless pen computer equipped with a 10.4-inch screen and touch-screen capabilities. The client software, running on J-Slate or another mobile device, uploads job information from the field to the corporate EFS system.



Both the Cartesia-Redline client software and the EFS application run on any machine equipped with a Java Virtual Machine (JVM). Tadpole-Cartesia is priced starting at $4,000 per client.

Tadpole-RDI Inc.
2300 Faraday Ave.
Carlsbad, CA 92008
http://www.tadpole.com
Circle 100



a standard wall clock profile of the application or any portion of it; Tracing, to trace subprogram calls and source lines executed in an application or any portion of it; and Timing, to time specific events or sections of code and to track memory usage.

Aprobe runs on Solaris 2.5.1+ on SPARC, with Sun Microsystems Inc. Sun Workshop C compiler 4.2+ or GNU C Compiler (GCC) 2.7.2+. A version for AIX is also available. A Windows NT version is scheduled to be available by the end of the year. Aprobe is priced starting at $39,495 for a 10-user license (price includes one week of on-site training).

OC Systems Inc.
9990 Lee Hwy., Ste. 270
Fairfax, VA 22030
http://www.ocsystems.com
Circle 102

Tape Array Offers High Performance

LibraryMaster from Ultera Systems is designed to offer high-performance, fault-tolerant data recovery to SCSI-based automated tape libraries. LibraryMaster's controller uses the bandwidth of two or more tape drives to generate sustained backup speeds of 40 MB/s, and uses RAID level 0 to stripe data across two to four tape drives to achieve maximum throughput, Ultera says.

The addition of a parity drive enables RAID level 3 operation to produce an extra layer of data protection and fault tolerance. Using this configuration, if one cartridge is damaged or lost, or if a tape drive fails, LibraryMaster will reportedly restore and rebuild lost data by drawing from the remaining tapes.

The system's mirroring mode guarantees maximum data availability. Because all data is written to two or more drives simultaneously, multiple copies are created in the same time it would normally take to record a single backup tape, Ultera says. An administrator can create multiple backup tapes, sending one set off-site for added protection, while keeping a duplicate set stored inside the library for dual-level fault tolerance.

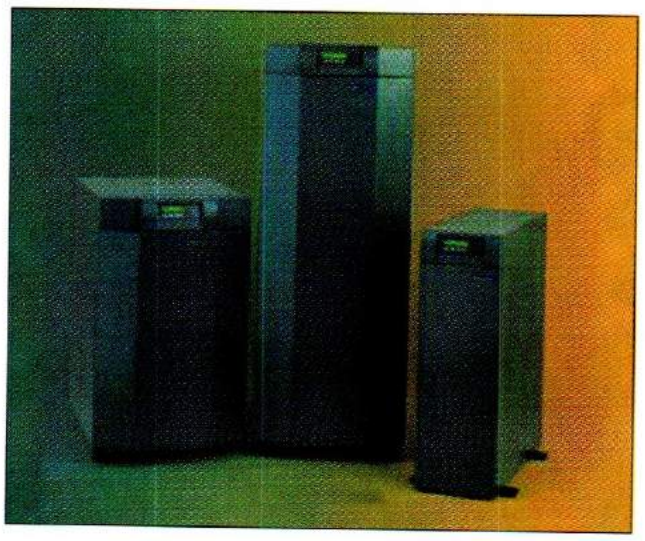
LibraryMaster operates transparently with backup software running on one of a number of operating systems, including Solaris, AIX, HP-UX, IRIX, DG-UX, Linux and Windows NT. It costs $14,550.

Ultera Systems Inc.
26052 Merit Circle, Ste. 106
Laguna Hills, CA 92653
http://www.ultera.com
Circle 103

DVD Storage for the Network

Plasmon IDE's AutoTower is a storage system that combines a network-attached storage (NAS) device with a DVD-RAM library. AutoTower with DVD-RAM is a multipurpose storage device for small to medium-size networks, which provides a low-cost, near-line rewriteable storage solution for content-rich data files, medical imaging applications, digital prepress and backup applications. It is intended to eliminate the high cost and complexity of maintaining jukebox storage on a network, while offering four times the capacity of CD backup media, Plasmon says.

Designed as a plug-and-play solution, AutoTower can be plugged into Ethernet, Fast Ethernet, Asynchronous Transfer Mode (ATM) 25/155 or Token Ring networks via a standard RJ-45 network jack. It can be configured in minutes without disrupting ongoing network traffic, the company says. Users access AutoTower files via Solaris, AIX, HP-UX, NetWare or Windows NT clients. HTTP support allows remote administration and management via a Web browser. AutoTower also includes a 9-GB hard drive for caching frequently used files. The cache is said to provide fast access to data by minimizing robotic movements within the jukebox.



Pricing starts at $14,000 for a two-drive, 120-slot system.

Plasmon IDE Inc.
9625 W. 76th St.
Eden Prairie, MN 55344
http://www.plasmon.com
Circle 104

Power E-Business Applications on UNIX

Merant has introduced Micro Focus Server Express, its latest and fastest solution for deploying e-business applications via UNIX. Micro Focus Server Express enables UNIX programmers to rapidly extend enterprise-level applications to the Web and other distributed platforms, reducing deployment costs and increasing overall service levels, the company says.

With an easy-to-use GUI, multithreading capabilities and remote debugging features, Server Express is said to reduce the time and resources required to develop, debug and deploy robust e-business applications. Built to work with most 32- and 64-bit platforms, including those from Sun Microsystems Inc., IBM Corp. and Hewlett-Packard Co., Micro Focus Server Express is designed to meet the needs of evolving e-business requirements, the company says. Server Express also works with leading RDBMSs, including Oracle, Sybase and Informix.

Server Express was specifically engineered to be compatible with existing Micro Focus COBOL applications, Merant says. In addition, it includes a state-of-the-art compiler that is said to build on COBOL's traditional strengths by providing extensive COBOL dialect support, full support for object-oriented application development and fully

portable multithreading capabilities.

Micro Focus Server Express costs $3,046 per developer seat.

Merant
701 E. Middlefield Road
Mountain View, CA 94043
http://www.merant.com
Circle 105

Rave Delivers Faster AXi Systems

Rave has introduced faster versions of its Rackmount-AXi and Tower-AXi systems. The new systems feature the Sun Microsystems Inc. Ultra AXi motherboard with an UltraSPARC-IIi 440-MHz processor. The Sun board also offers integrated dual-channel Ultra Wide SCSI support and six 32-bit PCI slots.

The Rackmount-AXi system is available in two models–the new RM-2UAXi or the RM-5UAXi–while the Tower-AXi is offered as the RT-AXi.

The RM-2UAXi comes standard in a 19-inch 2U form-factor chassis, with a 300W autoranging power supply, six cooling fans and two 33-MHz/32-bit PCI slots. Both rack-mount models hold up to 1 GB of memory, support Sun Creator graphics cards and can be preinstalled with Solaris 7.

The RT-AXi features the Ultra AXi motherboard integrated into a mid-tower chassis that is configured with three 5.25-inch and two 3.5-inch exposed bays and a 300W power supply. It too supports up to 1 GB of memory and can be preloaded with Solaris 7.

The RT-AXi costs $4,850, the RM-5UAXi costs $5,250 and the RM-2UAXi costs $5,500.

Rave Computer Association Inc.
36960 Metro Court
Sterling Heights, MI 48312
http://www.rave.com
Circle 106

Ultra AXmp Chassis

Rackmaster has introduced the Eclipse Fault Resilient Series (FRS) enclosure for the Sun Microsystems Inc. SPARCengine Ultra AXmp quad-processor motherboard.

The chassis comes with three hot-swappable, 400W power supplies. In the event one of the three power supplies fails, an alarm is triggered. The failed power supply can then be replaced through the rear of the enclosure without bringing the system down, Rackmaster says.

The Eclipse FRS comes with three 120mm, 90-cubic feet per minute (CFM) cooling fans for the chassis and three dedicated 60mm, 25-CFM cooling fans, one for each power supply. The fans are also hot-swappable.

Other features include nine 5.25-inch vertical-mount drive bays, two 5.25-inch horizontal-mount drive bays and two 3.5-inch horizontal-mount drive bays. In addition, multiple enclosures can be daisy-chained for additional online storage capacity, the company says. Eclipse FRS is priced starting at $4,320.

Rackmaster Systems Inc.
10640 Lyndale Ave. S.
Bloomington, MN 55420
http://www.rackmaster.com
Circle 107

Fast Ethernet Adapter for Embedded Systems

Znyx has announced a Fast Ethernet adapter for embedded computer systems with a PCI mezzanine card (PMC) bus. The NetBlaster ZX210 Series features a multichannel design that is said to allow system-level integrators to maximize local area network (LAN) connectivity within their system enclosures.

The Fast Ethernet adapter is available in two models: dual-channel (ZX212) and quad-channel (ZX214). Each model uses RJ-45 connectors integrated directly into a flush surface mount. This allows the computer systems to integrate with high-density multiport LAN systems without the need for external transition cables.

Znyx offers a broad array of driver bases supporting Solaris, Windows NT, pSOS, VxWorks, LynxOS, QNX, UnixWare and Linux. The dual-channel NetBlaster ZX212 PMC module costs $749, and the quad-channel NetBlaster ZX214 costs $1,049.

Znyx Corp.
48501 Warm Springs Blvd., Ste. 107
Fremont, CA 94539
http://www.znyx.com
Circle 108

Track System Data Across the Enterprise

Candle has introduced Performance Monitoring Network (PMN), an information service that tracks system data to conduct performance analysis.

PMN is a service Candle sets up and manages for its customers, which includes daily, weekly, monthly and quarterly reports on service levels, capacity and application monitoring. PMN collects data from various agents deployed on operating systems, subsystems and applications throughout the enterprise, Candle says.

Data can be monitored with agents across mainframes, Windows NT and UNIX systems, including Solaris and AIX. PMN also works with RDBMSs such as Oracle, Sybase and Informix. Pricing is based on the operating system's environment; contact the company for quotes.

Candle Corp.
201 N. Douglas St.
El Segundo, CA 90245
http://www.candle.com
Circle 109

Business Intelligence Tools Roundup

Business Objects has introduced the next version of its suite of integrated enterprise decision support tools. The suite includes the following tools: WebIntelligence 2.5, BusinessObjects 5.0, Broadcast Agent 5.0, BusinessObjects Set Analyzer and BusinessObjects Developer Suite.

WebIntelligence 2.5, an integrated query, reporting and online analytical processing (OLAP) solution for Internet environments, features a new API and a customizable user interface, which is said to allow users to tailor the WebIntelligence entry point to give it the same

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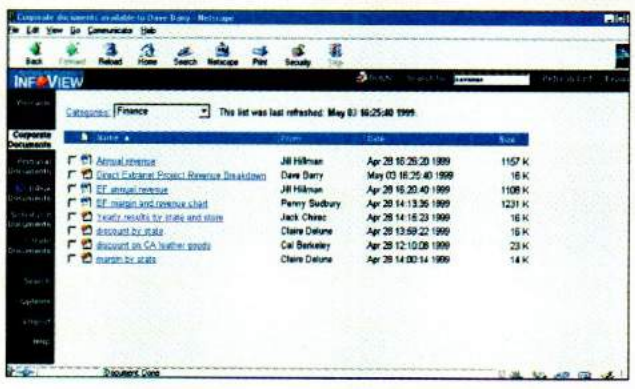
look and feel as their own Web site. In addition, WebIntelligence 2.5 now supports Solaris, AIX and HP-UX.

BusinessObjects 5.0 is an updated version of the company's flagship decision support tool. This latest version introduces analytical reporting, which integrates enterprise reporting functions with traditional decision support functions such as ad hoc access to corporate data, report creation and OLAP functions, the company says.

Business Objects Broadcast Agent 5.0 is a robust, multitier server that enables nontechnical users to quickly and easily publish and/or broadcast prebuilt or ad hoc reports on corporate data. Using a CORBA-compliant object request broker (ORB) distributed component architecture (DCA) first developed for WebIntelligence, Broadcast Agent is said to scale to meet the needs of users throughout the enterprise.



BusinessObjects Set Analyzer is new to the Business Objects product line. Using a process called set-based analysis, Set Analyzer reportedly enables users to perform complex query and analysis of very large data sets.

BusinessObjects Developer Suite repackages the components of Business Objects' full and thin-client business intelligence software, along with the company's broadcast server, the standard development environments of Microsoft Corp. Visual Basic for Applications (VBA) and Active Server Pages (ASP), Business Objects' standard API and additional sample programs and documentation.

WebIntelligence 2.5 is available now on Solaris and Windows NT, and is scheduled to be available on HP-UX and AIX by the end of the year. It costs $1,185 per user. Broadcast Agent 5.0 is also available on Solaris and NT, and is priced per server at $15,995 on UNIX and $9,995 on NT. BusinessObjects 5.0 ($1,185 per user), BusinessObjects Set Analyzer ($2,095 per end-user module) and BusinessObjects Developer Suite ($6,995) are available on Windows 95/NT.

Business Objects SA
2870 Zanker Road
San Jose, CA 95134
http://www.businessobjects.com
Circle 110

IMSL FORTRAN 90 Library for UNIX

Visual Numerics has announced Version 4.0 of its IMSL FORTRAN 90 Library for UNIX workstations. Previously, this product was only available for IBM Corp. RS/6000 SP and SGI Cray T3E platforms.

First introduced in 1970, IMSL (International Mathematical Subroutine Library) mathematical and statistical libraries are said to be used by more than 350,000 programmers, researchers and engineers worldwide.

Visual Numerics says its IMSL library is a comprehensive set of more than 1,000 mathematical and statistical analysis routines written in FORTRAN that can take advantage of multiprocessor environments.

In response to the growing demand for distributed computing solutions, the company has combined two of its products–IMSL FORTRAN 90 Library 3.0 and IMSL Distributed Network FORTRAN Library–to create Version 4.0 of the library. This latest version is said to contain the best features of both products: time-proven numerical analysis routines and support for distributed computing.

Also new to Version 4.0 is a Partial Differential Equation (PDE) solver and two linearly constrained, least-square solvers with optional Message Passing Interface (MPI)-enhanced distribution.

The IMSL FORTRAN 90 Library supports IBM RS/6000 SP, Cray T3E, UNIX workstations from Sun Microsystems Inc., IBM, Compaq Computer Corp., SGI and Hewlett-Packard Co.,

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and Windows-based PCs. Pricing starts at $695, depending on the platform and the number of concurrent users.

Visual Numerics Inc.
5775 Flatiron Pkwy., Ste. 220
Boulder, CO 80301
http://www.vni.com
Circle 111

Digital Content Manager for Linux

Photodex has released the first public beta of its CompuPic Digital Content Manager for Linux. The company has also introduced the first of a range of open-source shell utilities for the Linux developer community.

CompuPic allows users to manage, view and share images digitally. The software enables users to quickly and easily edit/manipulate images, add captions or "talk bubbles" and perform image correction, Photodex says.

CompuPic Digital Content Manager for Linux allows Linux users to access, manage and manipulate graphics and media files. CompuPic is said to provide a solid file management base for general

use, as well as specific graphics and media editing tools for more experienced users.

CompuPic Digital Content Manager for Linux is expected to be in final release sometime fourth-quarter 1999, and will

Upgrades, Enhancements, Additions...

■ Solid Data Systems, a leading manufacturer of intelligent solid-state storage systems, has announced that its Excellerator product line is now available through Sun Microsystems Inc.'s online store, SunStore (`http://sunstore.sun.com`). Solid Data's Excellerator systems have been awarded Sun's Solaris-Ready verification, which ensures products meet specific standards of compatibility and interoperability within a Solaris environment. The Excellerator systems are the first solid-state storage systems to carry the Solaris-Ready branding, Solid Data says. Excellerator is available in three models, 600, 800 Ultra and 1000 Ultra, which offer storage capacities of 1.34, 5.36 and 17.12 GB, respectively. Pricing starts at $21,400. The Excellerator products are listed with other Solaris-Ready third-party products in the online hardware catalog. **Solid Data Systems Inc.**, 2945 Oakmead Village Court, Santa Clara, CA 95051, *http://www.soliddata.com*. **Circle 112**

■ Ancot has released a new Web interface for its Ultra2080 SCSI Analyzer for testing SCSI bus performance. The new interface can be easily accessed via an Ethernet network or the Internet using any standard Web browser running on a host computer. The Ultra2080 SCSI Analyzer is priced starting at $7,995. **Ancot Corp.**, 115 Constitution Drive, Menlo Park, CA 94025, *http://www.ancot.com*. **Circle 113**

■ Numerical Algorithms Group (NAG) has released Version 4.0 of its NAGWare f95 Compiler. NAG created the first ISO/ANSI-based FORTRAN 90 compiler in 1991 and has now introduced the first compiler that implements features to be included in the next FORTRAN standard, FORTRAN 2000. NAGWare f95 is a FORTRAN 95 compiler designed for a range of UNIX platforms, including SunOS, Solaris, AIX, IRIX and Linux. This latest version features extensive compile-time and runtime checking and has been further enhanced with runtime procedure argument checking and subscript checking for assumed-size arrays. In addition, NAGWare f95 4.0 supports the new ISO/IEC Technical Reports TR 15580 and TR 15581. A 30-day trial version is available for download; contact company for pricing. **Numerical Algorithms Group Inc.**, 1400 Opus Place, Ste. 200, Downers Grove, IL 60515, *http://www.nag.com*. **Circle 114**

■ Allaire has announced ColdFusion Server 4.0 Enterprise for HP-UX. ColdFusion is Allaire's cross-platform Web application server for building and deploying Web-based systems that integrate browser, server and database technologies. Allaire says the addition of HP-UX support marks an important milestone in its commitment to provide a robust, cross-platform Web application development environment. ColdFusion Enterprise application server is also available for Solaris and Windows NT. The company plans to add Linux support with the product's next major release. ColdFusion Server 4.0 is licensed per server (for up to eight CPUs) and costs $3,495. **Allaire Corp.**, 1 Alewife Center, Cambridge, MA 02140, *http://www.allaire.com*. **Circle 115**

■ EasyCopy 6.0 from AutoGraph, an image capture tool for UNIX, now features a new GUI, an integrated image viewer and a fast image browser. For image printing, the GUI reportedly offers complete control of the printer setup and improved selection of page layout and color options. EasyCopy 6.0 includes EasyCapture, which gives the user the option of screen capture either from the GUI, the command line or via hot-key. EasyCopy supports a wide range of common CAD and desktop publishing image file formats, and provides additional filters for importing virtually any image or graphics file format, the company says. EasyCopy runs on Solaris, AIX, IRIX, HP-UX, Tru64 UNIX and Linux. **AutoGraph International Inc.**, 1782 Technology Drive, San Jose, CA 95110, *http://www.augrin.com*. **Circle 116**

■ BMC Software has announced certification of its Control-M Smart Plug-in for HP OpenView through the Hewlett-Packard Co. Premier Partner Program. The plug-in is said to allow BMC's Control-M production control and scheduling tool to support HP's portfolio of software solutions for network, server, application and IT service management, and fosters tight integration with the HP OpenView environment. Control-M manages the setup, scheduling and execution of business applications and legacy systems across multiple platforms, BMC says. Pricing for Control-M Smart Plug-in for HP OpenView starts at $9,000, depending on configuration. **BMC Software Inc.**, 2101 CityWest Blvd., Houston, TX 77042, *http://www.bmc.com*. **Circle 117**

be free for noncommercial use. List price is $39.95. Users wishing to join the public beta program should go to `http://www.linux.compupic.com`.

Photodex Corp.
1106 Clayton Lane, Ste. 200W
Austin, TX 78723
http://www.photodex.com
Circle 118

High-Capacity Disk Drives

Zzyzx Peripherals has announced high-capacity 36- and 50-GB disk drives. The new drives are optimized for Zzyzx's entire line of Fibre Channel, Low-Voltage Differential (LVD) Ultra 2 and Ultra SCSI RAID products.

When integrated with Zzyzx's RAID arrays, the new drives can provide more than 1.5 TB of storage in a single tower enclosure, the company says. Zzyzx RAID subsystems are available in 10-, 20- and 30-bay tower enclosures that provide 500 GB (10-bay) to more than 1.5 TB (30-bay) of storage space in a single unit. In addition, a 70-inch high rack-mount system is available with up to 450 GB of storage space in a single eight-bay unit, which with 10 units per enclosure is said to scale to more than 4 TB.

All the disk drives come with a five-year warranty. Service, support and express replacements for high-security classified facilities are also available. Contact vendor for pricing.

Zzyzx Peripherals Inc.
5893 Oberlin Drive, Ste. 102
San Diego, CA 92121
http://www.zzyzx.com
Circle 119

New Tower/Rack-Mount SCSI Arrays

PerifiTech has released Aerial Ultra 2 SCSI array subsystems with 80-MB/s throughput, hot-swappable 10,000-RPM hard drives and dual load-sharing power supplies. The Aerial U2 subsystems are available in either tower or rack-mount configurations.

PerifiTech's Ultra 2 SCSI arrays come with the Aerial U2 SCSI RAID controller, which supports RAID levels 0, 1 (0+1), 3 and 5, and Just a Bunch Of Disks (JBOD) multihost configurations. This is said to allow several servers to share a single array. Other features include a 128-MB read-ahead/write-back cache, an integrated 133-MHz CPU and an LCD display that provides setup and diagnostic information.

Options include an Ultra 2 SCSI Channel Expansion Adapter, to double the number of SCSI channels from three to six, and a battery backup module. The Aerial Ultra 2 SCSI arrays provide storage for Solaris, NetWare, WinFrame/MetaFrame, OS/2 and Windows NT environments. Pricing starts at $9,099.

PerifiTech Inc.
1265 Ridge Road
Hinckley, OH 44233
http://www.perifitech.com
Circle 120

Email-Based CAD Install Method

Avatech Solutions, a nationwide provider of desktop design automation technology, training and services, is currently offering email-based installation and configuration for CAD programs such as AutoDesk Inc.'s AutoCAD and associated add-ons.

Traditionally, Avatech says, CAD installation was time-consuming and required hands-on help from technical support specialists, particularly when network-based systems were involved. With Avatech's email-based install method, users receive an email message with their CAD licenses that contains a file attachment. The user simply double-clicks on the file attachment to install the latest version of the CAD program, add-ons and other programs, the company says. It should take only about five minutes to run. Because this method is based on enterprisewide CAD standards, it emanates costly inconsistencies and high support costs normally associated with these kinds of installations, Avatech says. Contact the company for product and licensing information.

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Circle 121

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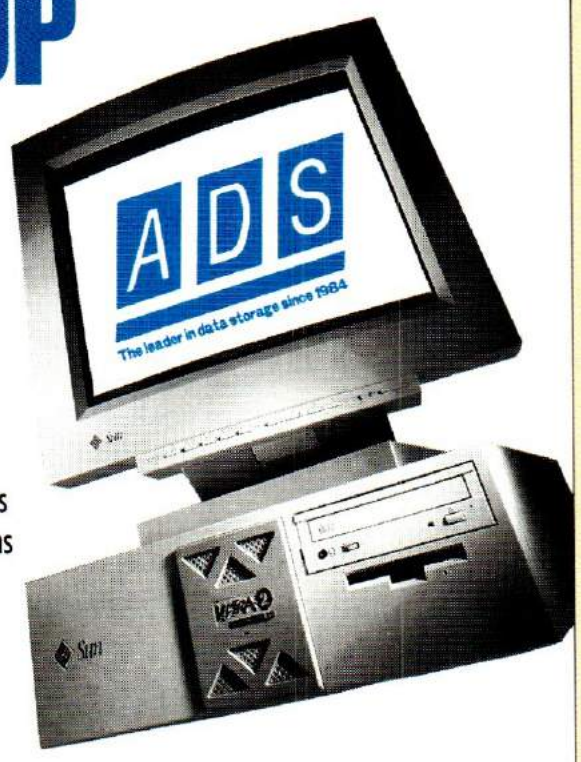

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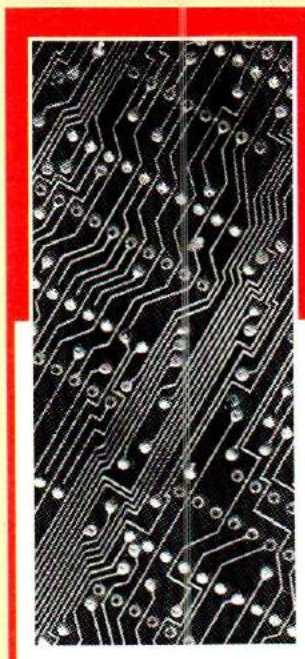

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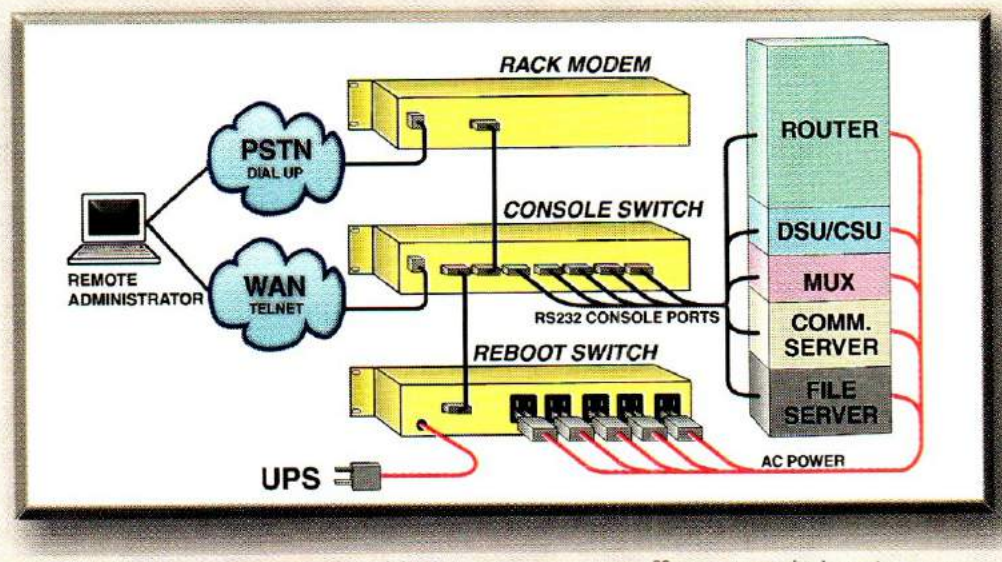

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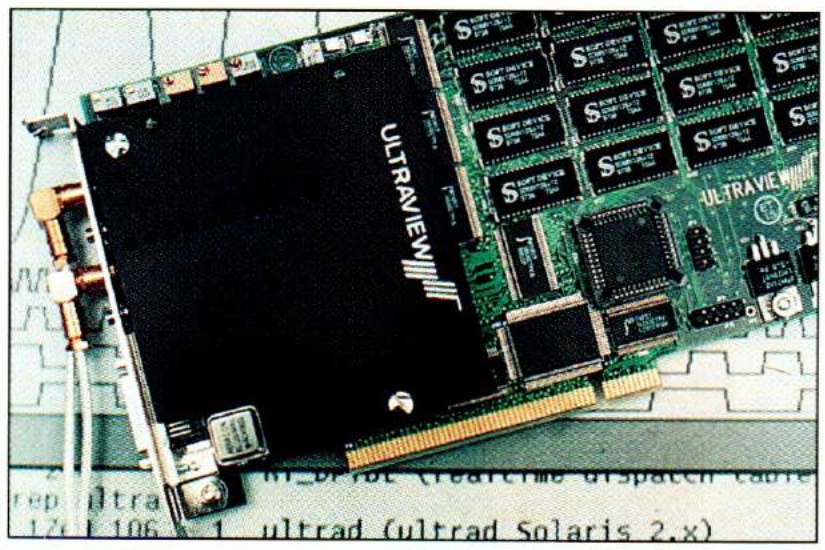

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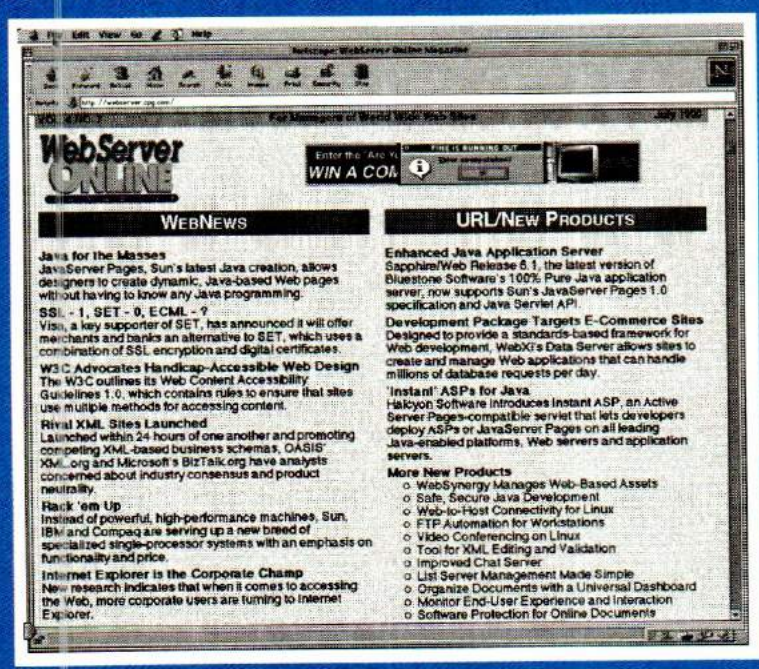
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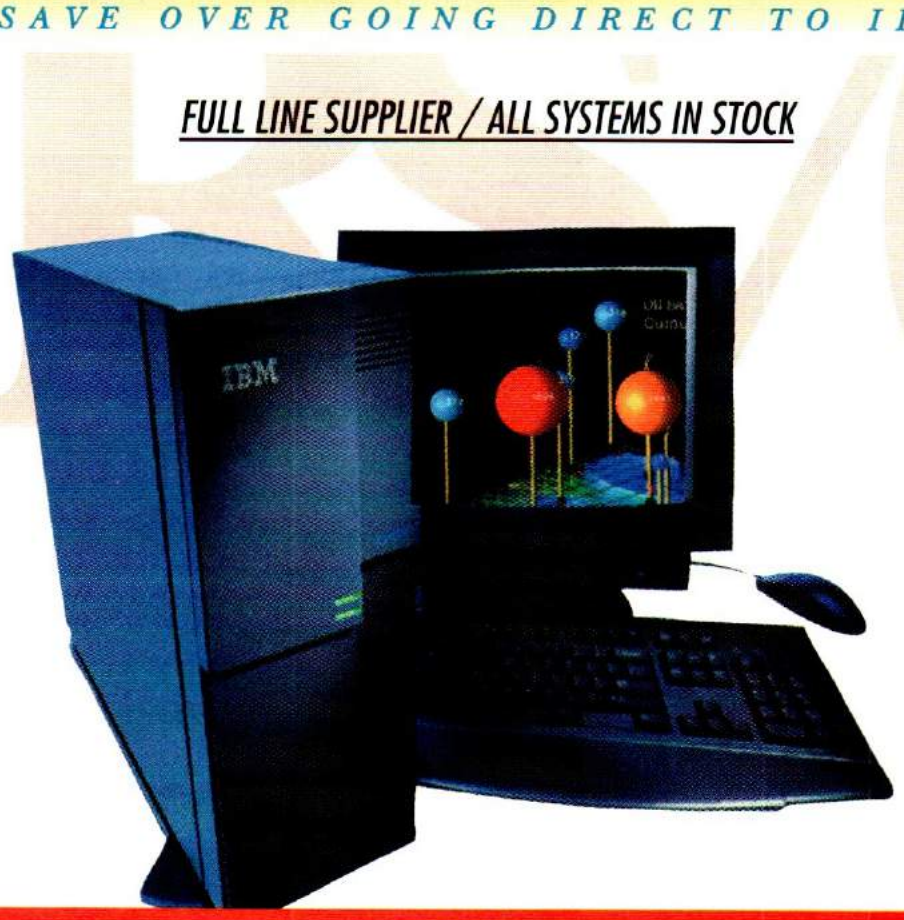

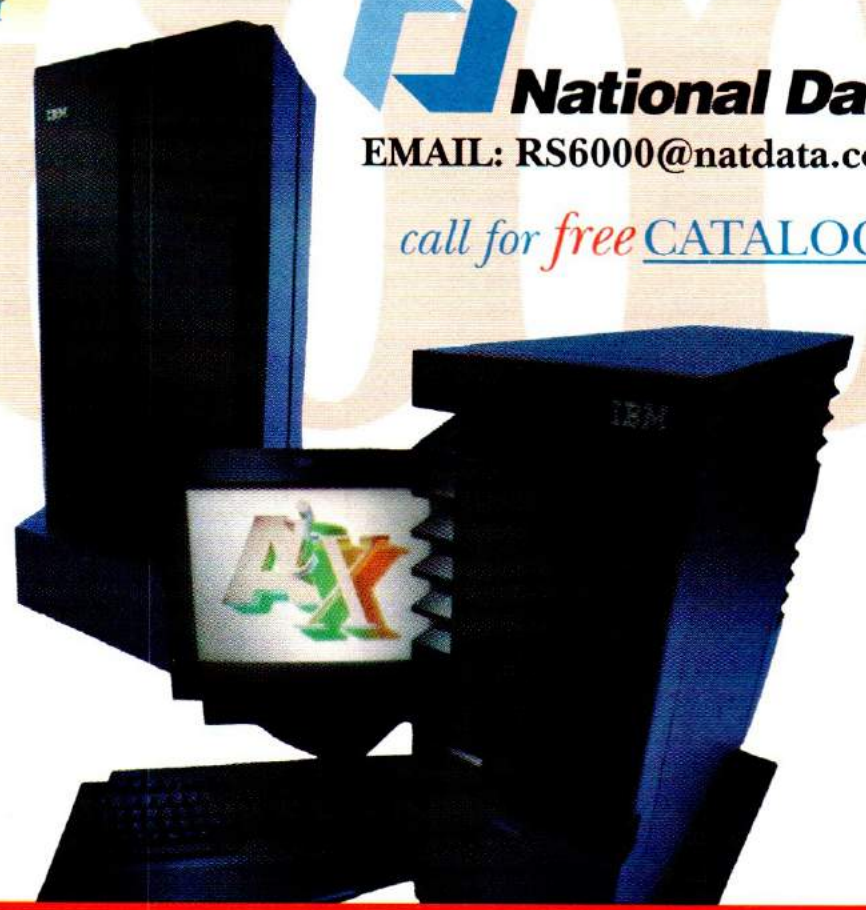

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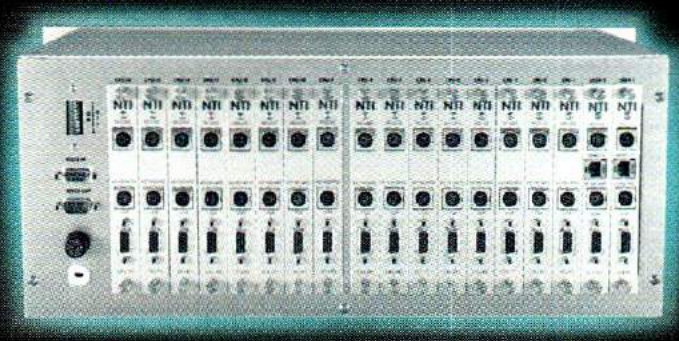

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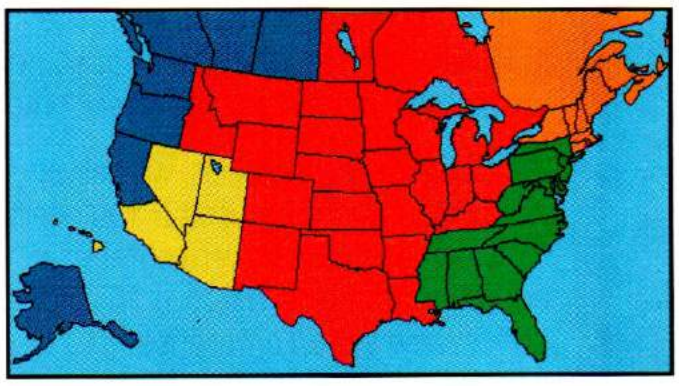

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Reader Inquiry Number	page
4.....ADIC	9
439..Advantec - ACCI	75
15....American Power Conversion	33
348..Ames Sciences	78
5.....Andataco	11
442..Apcon	71
402..Applied Digital Systems	68
316..Atlantic Peripherals	78
24....ATL Products	BC
20....Bridgepoint Technical	57
362..Clearpoint Enterprises	72
367..Computer Connection	78
376..Comtek Computer Systems	69
447..Confluent	75
12....Consan	25
3.....Cycle Computer	7
454..Datalease	72
455..Datalease	75
352..Datalease	78
.....DCI	50
363..Eli Systems	69
18....Encore	47
9.....Encore	28
357..Evolving Solutions	77
404..Express Computer Systems	77
372..Express Point	76
421..Facet Corp.	79
.....Fall Internet World	C3
361..GEAR Software	73
353..GSH Systems	72
422..Gulfcoast Workstation	79
.....IBM	19
.....ICE	35
.....Intel	4 & 5
19....IntraServer Technology	37
379..Kingmax	76
2.....Lightwave	1
330..Michaura Systems	68
431..Monitor Technology	78
343..National Data	77
366..Network Technologies	79
340..Nordisk	74
5.....n'Stor	11
346..Nu Horizon	68
345..One Source	76
413..Open Systems Express	78
17....Personal Productivity Tools	28
21....Polaris	51
11....Radware	23
10....Raritan Computer	21
13....Rave	27
8.....Resilience	17
314..Security Computer Sales	69
401..Security Computer Sales	71
438..Security Computer Sales	73
1 .....Software Engineering of America	C2
411..Solar Systems	75
22....Sun Microsystems	65
23....Sun Microsystems	67
7.....Tatung	15
6.....Tecmar Technologies	13
453..The Hyde Company	72
428..Trident Systems	71
420..TriniComp	70
375..Ultraview	73
320..Universal Capital Funding	68
332..Virtual Technology	74
368..West Coast Computer Exchange	73
324..Western Telematic	70
333..Workstations International	72
342..Worldwide Trade Corp	76
16....XCEL	29
14....Xi Graphics	31

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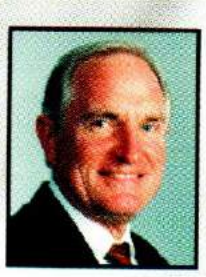

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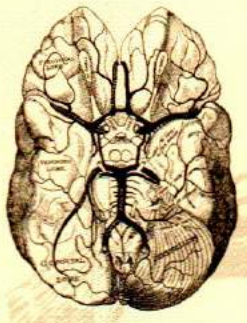
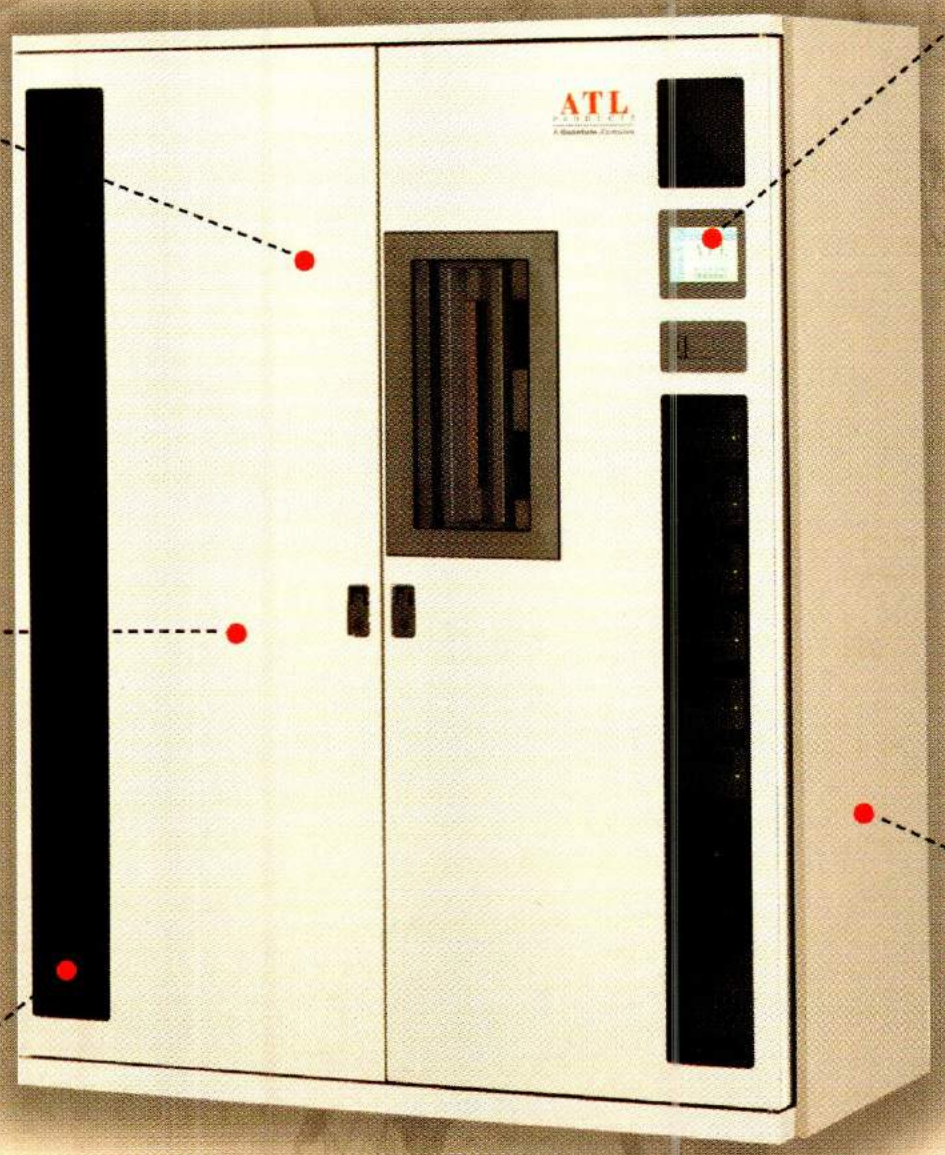


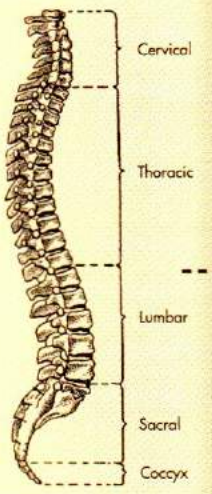
I. The Brain – *Much like "some" human brains, the P3000 has a massive capacity to store and move information. This intelligent library has a native capacity of 11.4 terabytes and blazing performance of 288 gigabytes per hour.*

II. The Eyes – *With local and remote browser GUIs, you'll see the industry's most powerful DLTtape library is incredibly easy to use.*



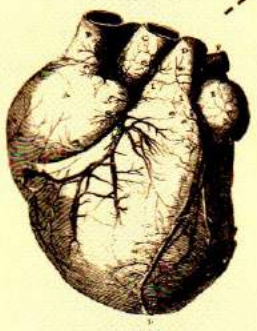
III. The Skeleton – *The human body has two arms and two legs. The P3000 delivers the same high availability (HA) design with redundant AC cords, power supplies and fans. Plus, the power supplies, fans and DLTtape drives can be hot-swapped.*

VII. The Spine – *The backbone of the P3000's design is a PCI expansion bus supporting SCSI interface, Fibre Channel, tape array and server PCI cards – "future proofing" your library with a modular upgrade path.*



Divisions of the Spine

IV. The Nervous System – *The complex nervous system of the P3000 is designed to support multiple concurrent network, SCSI and fibre channel connections, so each library can be shared by NAS, SAN and direct-connect environments.*



VI. The Heart – *The heart of the P3000 is the IntelliGrip precision cartridge handling system which will pick-and-place cartridges for years without skipping a beat.*

V. *Like a well-tuned body, The P3000's reliability, redundancy, ease of use and modular upgrades all add up to low total cost of ownership (TCO).*

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